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Experiences Encountered in the Establishment of an Industrial Health Service

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THESE remarks are directed primarily to those who are interested in the setting up, and maintenance, of a health service in industry. Since they refer to one's own participation in a number of such ventures, it necessarily follows that the personal factor can not be excluded. Again, what I propose to bring to your attention may prove to be nothing more than a repetition of what you have heard before but it may be the type of commonplace that we are all too apt to forget and that requires to be brought to our notice periodically.

In the time at my disposal it is quite impossible to give consideration to all the points that warrant our attention, so that I have confined my effort to the ones that appeal to me as being of prime importance.

Relationship With Management

Without exaggerating in the slightest, let me say that your whole set-up may swing on the decision arrived at regarding the status of the official to whom you report. By all means see to it that you have access to the highest-ranking official in the plant. Whether you are instituting a new service or taking over from a predecessor, you may be sure you will be watched by all employees. They will be anxious to learn just where you fit into the scheme of things. Given an opportunity to learn what the men in the plant are saying about you, will it be—

(a) There are no halfway measures with the doctor; he goes straight to the general manager OR

(b) The doctor has to be satisfied with relaying his information through one of the lesser lights so it looks as though he does not rank too highly with the manager.

Presented before the Section of Industrial Hygiene at the thirty-fifth annual meeting of the Canadian Public Health Association, held in the Château Frontenac, Quebec City, Quebec, May 20-22, 1947, in conjunction with the annual meeting of the State and Provincial Health Authorities of North America.

Criticism, and I do not mean the constructive variety, will come from all ranks of employees and the farther removed they are from a knowledge of organization the more severe will be that criticism. Conversely, those same employees will rate you highly if they see you associating with management. It is simply an adaptation of the old saying, "A man is judged by the company he keeps." All too often, unfortunately, the dollar sign is the standard by which we are gauged.

Nature and Extent of Service to be Rendered

This will depend, of course, on the understanding you have already reached with management. Will it be mere "window-dressing" or an honest attempt to give service? Unfortunately, and too often there are, in my opinion, officials who will do as little as they can—just enough to get them in under the wire, whether it be legal requirements or popular demand. Conversely, there are those who will be satisfied with nothing short of an all-embracing scheme for their employees, whom they look upon as an integral part of their organization and for whom nothing is too good. Such employers have both the desire to promote good health and the funds to accomplish their aims. Somewhere between these two types of service is to be found the vast number of industrial health units.

Having decided upon the type of service, it becomes your privilege to apply yourself diligently. It may be that you are to carry out a program of first-aid—no more, no less. If so, a personal interest in the employee who seeks your aid, as well as careful attention to every detail of the treatment given him, will pay big dividends. To say the least, you will have the satisfaction of having done your work well. There may be much more than that—you may gain the friendship of that employee, and that is surely worth striving for. The gratitude and esteem of a satisfied patient is something to be prized very highly.

If your program calls for pre-employment examinations, you will have an opportunity to observe abnormal conditions which otherwise might not be diagnosed until radical treatment is indicated or even until the prognosis is hopeless. What an opportunity!

Have you any chance to employ preventive measures? Is your advice sought at the first sign of a "cold" in the head or about a cough that has persisted for weeks? Does someone come to you because of a pain in the abdomen which may be the beginning of an attack of acute appendicitis? Are you asked for an opinion regarding an attack of "indigestion"? Have you the confidence of the employees to the extent that they will come to you with their "problems"? If so, you have accomplished much. These are just examples upon which you may be asked to give advice, or to undertake treatment; depending, of course, on the extent of your service. They represent the opening up of a wide field of endeavour and bring me to a point which I wish to make.

Until comparatively recent years we of the medical profession were concerned only with the treatment of accidents, injuries, and various well-established illnesses. This, in my opinion, is Negative Medicine. Contrast this with the situation as we have it today. With the advent of public health and preventive medicine our attention has been directed to the procurement, and maintenance, of good health; the reverse of what was mainly our former objective. This, I contend, is Positive

MEDICINE. Let me invite you to look at it henceforth from that point of view. Here is the opening we have been looking forward to; here we are afforded the chance to attack disease in its incipient stage. This is the time when Nature, with a little assistance from us, is able to wage effective battle with the enemy and win the struggle with a minimum of damage to the individual. I know of no instances where this form of practice can be carried out more advantageously than in industry and in schools where we have groups with which to deal and where we can not only educate people along the proper lines but also demonstrate to them the value, in a practical way, of what we preach. Given the opening, we can prove that preventive measures will reduce lost time due to illness or accident and once the results of such practice have been experienced the individuals concerned will rally to the cause. Here is a golden opportunity, and to none is the opportunity given in greater measure than to those of us who are engaged in industrial medicine.

Time does not permit me to outline all the activities that go to make up a complete medical service. However, I do wish to bring to your notice a matter which, to me, is of great significance. When a limited form of service has been decided upon, where are we to draw the line between the treatment we shall render and that which is considered beyond our field and, therefore, passed on to the general practitioner or to the specialist? It is easy enough to decide to dress a simple abrasion and, with equal readiness, we will not take on the treatment of a fracture of a femur. These may be accepted as the extremes—but what about the conditions we meet with as we come nearer and nearer to the border-line? Let me cite a few examples.

(1) If someone comes with wax in one or both ears, are we going to remove that wax or are we going to refer him to an ear, nose and throat specialist? We are going to remove that wax.

(2) Are we going to remove a small, superficially placed foreign body from an eye, or must the patient go to an ophthalmologist? Here again, we will undertake the treatment. Please be assured I am not thinking of a foreign body embedded in an eye. I am sure you will agree that is definitely for the ophthalmologist.

(3) Are we going to rush the young chap off post-haste to the internist at his first mention of a "lump in my stomach" or "heartburn" OR are we going to advise in a general way and then refer him to his family physician? Naturally, we are going to offer him some sound advice and then recommend that he see his own doctor promptly.

(4) What of dysmenorrhoea? Often one can institute treatment so that the patient may be absent from work for a few hours. But, if repeated too often, should not this patient then be referred to a gynaecologist for further investigation?

(5) What of a sore throat, a sprained ankle, or a headache? The above examples are only a few of numerous similar conditions we may expect to meet daily and we must be equipped to evaluate them and provide treatment.

Accommodation

It would be an exaggeration to say that your success or failure depends upon the accommodation provided but quite definitely the arrangement of the various rooms can add much to general efficiency. The requirements vary with each individual unit and will depend upon the nature and extent of the service provided. The simplicity or, conversely, the luxuriousness, of the appointments will depend upon the degree to which the scheme has been sold to management.

Staff

The choice of staff is of paramount importance. Records are a necessity and as a clerical staff is required to take care of them it seems logical to begin with the clerical section. Here I shall mention the receptionist first. She need not be old but, generally speaking, she should not be too young. In my opinion a good receptionist will exhibit the following attributes—(a) attractive appearance, (b) pleasing personality, (c) a kindly interest in the welfare of the patient. First impressions are lasting so that I mention an attractive appearance first. A pleasing personality is a real asset, but, to my way of thinking, most important of all is a kindly interest in the patient. The attractive appearance and the pleasing personality will fade into the background if the patient finds himself accepted as an individual rather than as just another name to be recorded on the daily log and another card to be drawn from the files. From a purely selfish angle, if for no other reason, it is good policy to cater to the individual's ego. Such attention quickly gains the confidence of the patient and you will find that your activities are away to a good start, and ideally paves the way for the nurse, or doctor, or both!

The nurse is the next member of staff with whom the patient comes in contact, and all that has been said about the desirable qualities of the receptionist can be repeated. *Age* often inspires confidence and should be considered when choosing a nurse, and particularly the senior nurse. We of the human species must have someone in whom we can confide and the nurse, in the majority of instances, should be capable of filling this role. Unless she is equipped to inspire confidence, it means that the doctor will have to do so himself, as gaining the patient's confidence is one quality that is always essential. The nurse who can bring to her aid tact and diplomacy will do much to promote good relationship between the employees and the Health Centre. Without good relationship the workers will derive little benefit and management will be deprived of the returns which they are entitled to expect from the money expended in operating a health unit. The nurse should be able to reduce conversation to essentials, without allowing the patient to become garrulous, and so expedite treatment. One of her more important functions is to decide whether or not a patient should be seen by the doctor. She must not assume the role of diagnostician but her experience will usually tell her where to draw the line. Then, she can be expected to pay more attention to repeat visits. Some patients will not be satisfied with anything short of an interview with the doctor but a nurse who exercises good judgment will reduce these interviews to a minimum.

Practically every industry today employs many former servicemen. This fact raises a point to which I wish to allude. Many of these people have had some difficulty in adjusting themselves to civilian life and are deserving of special consideration. On reporting to the Health Centre, especially on the occasion of the first visit, they often feel decidedly ill at ease. This is when the nurse who has been in one of the services can do a great job. Be sure she displays her service badge prominently on her uniform. The patient will spot it and it is surprising how quickly one can detect a change in his attitude. One can almost visualize his thoughts as he says to himself, 'Here's someone to whom I can talk, who understands my language and who can appreciate my problem.' I have watched this little by-play a goodly number of times and it is gratifying to see how quickly the patient can be put at ease by the nurse.

Finally, we come to the doctor and there is little I need say as to the qualities he must exhibit. Let me make just this one observation. Or shall I say "two"? First, the doctor's most important attribute, apart from his professional qualifications, is an honest and sincere liking for his fellow-men. With this as a basis upon which to build he is sure to attract people to him. That is the crux of the situation in so far as his successful handling of his position is concerned. Second—and it depends largely on the first point—happy is the doctor who can inspire confidence in his patients. I shall illustrate that by telling you of a conversation I once had with a man who, at that time, was very prominent in medical circles. He said, "Remember, Hill, the practice of medicine is 5 per cent faire and 95 per cent savoir faire."

Records

A few moments ago I mentioned records. Much can be said on this subject but I shall endeavour to make my remarks as concise as possible. Records are a very necessary part of any organization. They may supply a paucity of information or they may be replete with valuable knowledge, depending upon the amount of money management is willing to spend on them. Be as precise as possible irrespective of how detailed your records may be. During the time I was actively associated with industry I learned to make a note of the exact time at which I was advised of an accident, and of subsequent phases of the case. If the accident became the basis of legal action I can recall instances when the Court was favourably impressed at being told—

(1) The exact time when one learned of the accident.
(2) Precisely when the patient was first seen.
(3) The hour and the minute when treatment was instituted.
(4) Just when any complication was first noted, etc.

It is well to record such details since they can refute any charges that might arise. It requires but a little schooling to develop such a habit and it can save one many a headache.

The confidential nature of one's records is something which I can not stress too strongly. This is a matter about which there should be the most definite understanding with management. Confidential information should be available to no one except with the freely expressed written consent of the patient. There

should be no question of compulsion or suggestion, not even to the slightest degree. Better for a doctor to refuse a lucrative appointment than to barter his principle! Before signing any contract with industry, recognize and defend your obligation to the patient. Know precisely your relationship to management.

Criticism

Some are never satisfied no matter what effort we may expend in their behalf. They prefer the first-aid man in his dingy spot down in the plant to a modern Health Centre, with its new doctor, nurses, records and fancy offices. They understand the old order, resent the new, and are sorely in need of the educational side of any health program.

There is the "Bunk-house Lawyer"—the fellow who has a solution for all the ills of his fellow workmen and loudly and longly expounds his aims to any audience that will listen to him. He has contempt for the Health Centre and all it stands for and overtly airs his views. Such people do exist. I have heard them, have caught them red-handed and have smiled at their confusion when they realized they had been found out.

There is the young woman who reported for general physical examination, an examination quite the equal of that required by any insurance company. It included chest x-ray, urinalysis (chemical and miscroscopical) and blood for Wassermann. Yet she was disappointed at not having an electrocardiogram.

Another individual felt let-down because the examination did not include a B.M.R. Still another wondered why he could not have his varicose veins treated in the most approved manner.

Such instances show the need for explaining the real functions of the health centre and the inability to please everyone OR a combination of the two.

Appreciation

Happily, there are those persons who do appreciate our efforts on their behalf and also some cases from which we have derived no small degree of satisfaction. A few instances follow:

A man consulted us because of a "cold" of a week's duration. Clinically he had lobar pneumonia, which was corroborated by x-ray. He was sent home and, as a matter of policy, his doctor was notified. The patient made an uneventful recovery. His doctor was pleased with the service we had been able to render him and the patient returned to express his appreciation.

In the course of a routine re-examination, which includes chest x-ray, a young woman was found to have a minimal tuberculous lesion of one lung, asymptomatic but active, and was considered one of the earliest lesions ever seen by specialists in that disease. Our satisfaction lay in the fact that the lesion had been found so early that her residence in sanatorium would be reduced by months and even years and, also, that the danger of infecting contacts had been eliminated.

Of a similar nature was the man who reported to us as "not feeling quite himself," and was found to have far advanced bilateral pulmonary tuberculosis. There were six in the family and four were found to be affected. It is safe to say

the others soon would have been infected but for the fact that this man took advantage of service that was there for his benefit and there for the asking.

Numerous instances come to mind of people who have expressed their appreciation of the attention given them.

There was the case of the man whose radius was fractured and of another man who suffered a fracture of his right ilium. In both instances the family physician was notified and was given details of the treatment we had instituted. The patients were sent to hospital and their relatives notified. These are simply instances of another group.

There are those who have given us credit for having kept them at work throughout the winter as a result of our preventive measures whereas in previous years they had lost considerable time because of frequent attacks of the common cold.

Attacks of acute tonsillitis and of acute otitis media have been aborted while others have been referred to the family physician or the specialist for prompt and successful attention.

Many have been the instances where information has been requested, or proffered, concerning nutritional requirements, health habits, etc. There is a real need for an intensive educational program in this particular field.

Summary

By way of summing up let me point out the following:

(a) The Health Centre's aim is not primarily treatment but rather an attempt to insure people's continuance at work by the use of improved preventive measures. That is why it is so important to have everyone know the exact scope of the service. If this can be accomplished properly, we may look for less of the adverse criticism to which I referred.

(b) The establishment of periodic examinations is important but I have to remind you it is time-consuming. Furthermore, the Health Centre requires to be developed considerably before such a procedure can be taken on to advantage, i.e., before the necessary material is available.

(c) The nature of the cases seen in the Health Centre provides an interesting study. Compare those of your early months with the ones you see after you have become established, e.g., the man who comes with his family problem; the case of amenorrhoea, referred to her family physician and who came back to express her thanks for the consideration she had been shown.

(d) Co-operation with the family physician is aimed at and may take some time to attain. Often the family physician feels that his field is being invaded by the industrial physician, but such a misunderstanding can usually be cleared up without much difficulty. In a few instances a good deal of educating is required before harmonious relations can be established.

(e) In order to express, in a non-committal way, our assessment of the individual's physical condition, we have resorted to categorization. On the surface it may seem a simple matter to rate a person according to his condition and his ability to work but we have spent considerable time on such a classification. We

have already altered the original draft and will probably find it advisable, even necessary, to do so again.

(f) Records may be developed to the point where it is possible to predict a trend or even an epidemic. A good example of this, I believe, is the statistics of The General Motors Corporation's medical service and Dr. Fulton in particular. I am sure you will agree with me that he has made an unusually complete and exhaustive study of this branch of industrial medicine. He has done us a great service and it is most fortunate that he is associated with a concern that has both the inclination and the funds to promote such research.

In conclusion, I recognize this paper is in marked contrast to the usual scientific one. However, I trust you may derive some benefit from the points I have tried to make, all of which appeal to me very strongly.

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Tetanus Toxoid—The Recall Dose

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TETANUS toxoid has won an established place among the agents for active immunization and its worth and use are becoming more widely recognized. A number of reasons account for this increasing popularity. In the first place, the clinical nature of tetanus and the high case-fatality rate associated with it encouraged the use of an effective prophylactic, which tetanus toxoid has proved to be; secondly, the employment of this antigen obviates the necessity for use of tetanus antitoxin with its concomitant risk of serum sickness or anaphylaxis; thirdly, its combination with other immunizing agents has facilitated its use; lastly, the brilliant results achieved in the abolition of tetanus in the armed forces by means of tetanus toxoid point to similar possibilities in civilian affairs.

The procedure for immunization against tetanus is essentially similar in pattern to that for diphtheria, consisting of a primary course of injections followed by recall doses at intervals. What the strength of this recall dose need be, when it need be given, and what reactions, local or general, accompany its use have not been clearly established. While in the Canadian armed forces an annual recall dose was employed, with a further dose at the time of wounding, this was almost certainly more than was required for adequate protection. For civilian use the minimum number of injections and amount of antigen consistent with effective antitoxin levels is desirable. For this reason the present study of the recall dose of tetanus toxoid was undertaken.

Procedure

A group of 149 young adults, the great majority of whom had been previously immunized with tetanus toxoid either singly or combined with typhoid and paratyphoid vaccines (T.A.B.T.) while in the armed forces, was selected for study material. Preliminary blood samples were obtained immediately prior to administration of a recall dose of 0.1 or of 1.0 cc. of fluid tetanus toxoid containing 10 Lf per cc. Reactions to toxoid were read in 24 hours. Blood samples were obtained 4 weeks later and antitoxin* titrations carried out, using the mouse as test animal.

*Antitoxin titrations were based on the American Standard (U.S.P.) unit of tetanus antitoxin.

Results

Group A—Recall Dose of 0.1 cc. (1 Lf) Tetanus Toxoid

Of 85 persons who received the 0.1 cc. (1 Lf) dose of tetanus toxoid, only 67 who had a previous history of immunization with this anitgen were available for a second blood sample. The results for this number are shown in Table I, which reveals the antitoxin level of each individual before and after the recall dose and the geometric mean of the antitoxin titres at the second bleeding for those in each of the first bleeding categories.

TABLE I

Frequency of Occurrence of Individuals with Indicated Antitoxin Titres in Units per cc. of Serum Before and 4 Weeks after a Recall Dose of 0.1 cc. (1 Lf) of Tetanus Toxoid

Number of Persons with Second Bleeding Titres of	Number of Persons with First Bleeding Titres of										
	< 0.01	0.01	> 0.01 < 0.1	0.1	> 0.1 < 1	1	> 1 < 10	10	> 10 < 100	Totals
< 0.01	1									1
0.01										
> 0.01 < 0.1										
0.1	1									1
> 0.1 < 1				1						1
1			1		5		1			7
> 1 < 10		1	4		21	7	9			42
10			1		2	1	2			6
> 10 < 100			3		4	2				9
100 & >										
Totals	2	1	9	1	32	10	12			67
Antitoxin Titre at 2nd Bleeding—Geometric Mean		2.0	5.8	0.2	3.7	6.5	4.9			3.6

According to Table I it is apparent that 11 persons failed to respond within the limits tested. There may have been undetected increases, however, among these. At the worst, then, to this small stimulus, 56 or 83.6 per cent showed a response, though in some cases it was very slight. Of the 11 failures, 10 already had > 1 < 10 units of antitoxin per cc. of serum and are not so significant in view of this relatively high initial titre. The remaining individual had < 0.01 unit before and after the recall dose and represents a failure to develop a protective level of antitoxin. According to military service records he had received a course of 3 doses of T.A.B.T. followed by 2 recall doses of T.A.B.T. of 0.5 cc. each, the last one being given in July 1943, or three

and one-half years previous to this present recall dose. This result may be due simply to individual variation in ability to respond, a factor which is clearly demonstrated in the table, or to too small a stimulus, or to failure, possibly, actually to receive the immunization indicated in his service record. That individuals with < 0.01 unit of antitoxin can respond is shown by the second person in this category whose titre rose to 0.1 unit.

The geometric mean of the titres for the whole group before and after the recall dose was 0.49 and 3.66 units respectively. This represents approximately a seven-fold increase in response to the stimulus of this small recall dose.

Group B—Recall Dose of 1.0 cc. (10 Lf) Tetanus Toxoid

In this group of 64 persons, 55 who had a previous record of immunization with tetanus toxoid completed the tests. Relevant data for these persons are presented in Table II.

It is apparent from Table II that all but one person had an increase in titre following the recall dose of 1.0 cc. Actually, a slight response did occur in this case (from >20 < 50 to 50 units) but is not shown in the limits presented

TABLE II

FREQUENCY OF OCCURRENCE OF INDIVIDUALS WITH INDICATED ANTITOXIN TITRES IN UNITS PER CC. OF SERUM BEFORE AND 4 WEEKS AFTER A RECALL DOSE OF 1.0 CC. (10 Lf) OF TETANUS TOXOID

Number of Persons with Second Bleeding Titres of	Number of Persons with First Bleeding Titres of									
	< 0.01	0.01	> 0.01 < 0.1	0.1	> 0.1 < 1	1	1 > < 10	10	> 10 < 100	Totals
< 0.01										
0.01										
> 0.01 < 0.1										
0.1										
> 0.1 < 1			1							1
1										
> 1 < 10	4				6					10
10					4	1	2			7
> 10 < 100			2	2	19	2	9		1	35
100 & >					1	1				2
TOTALS	4		3	2	30	4	11		1	55
Antitoxin Titre at 2nd Bleeding—Geometric Mean	3.6		5.8	44.7	17.7	36.6	23.6		50.0	17.5

in the table. Thus, 100 per cent of this group responded to the 1.0 cc. recall dose albeit the response was slight in some cases. The wide individual variation is again apparent, with only a minor shift in titre in some and spectacular changes in others. One person, for example, with < 0.01 unit developed > 3 <10 and another changed from > 0.1 < 1.0 to > 100 < 120 units.

The response for the whole group is shown by the geometric means of 0.54 and 17.49 units of antitoxin before and after the recall dose, representing approximately a thirty-two-fold increase. The results for this small group suggest that those with little antitoxin to begin with have a greater proportionate response, though, as expected, they actually produce less antitoxin than those with high initial titres.

In addition to Group A, 9 individuals who had not had previous tetanus toxoid received the 0.1 cc. dose of antigen. With one doubtful exception, none developed antitoxin. Similarly, 5 persons not previously immunized with tetanus toxoid received the 1.0 cc. dose along with Group B. Of the 5, one showed a definite antitoxin response—from < 0.01 to 0.1 unit, and one other a doubtful response. It would appear, therefore, that at least the occasional individual will respond to a single primary stimulus of 1.0 cc. of this antigen.

Another point of interest is that 2 persons in Group A and 4 in Group B had < 0.01 unit of antitoxin before the recall dose. Investigation of the immunization record of these individuals while in the armed forces revealed no record in one instance; a primary course of T.A.B.T. completed in 1943 in another; 2 doses of tetanus toxoid in 1941 with a recall dose in 1942 in a third; 1 dose of T.A.B.T. in 1942 and a second dose in 1944 in the fourth and 0.5 cc. T.A.B.T. in 1941 in the fifth. The sixth person, the one who failed to respond to the 0.1 cc. recall dose (discussed above), had received 3 doses of T.A.B.T. in 1941 with a recall dose of 0.5 cc. in 4 months and again 2 years later. It is not surprising, therefore, that some of these persons had no detectable antitoxin initially when the time interval and irregular nature of the immunization is considered. It is reassuring that, with the one exception, they should respond so well to the recall dose.

Reactions

Reactions, local or general, to these recall doses are shown in Table III.

It is at once obvious that the number showing some degree of reaction is appreciable and approximately twice as frequent as well as more severe with the larger dose. Actually, however, none of the reactions was disturbing, those classed as general being mostly some degree of headache, nausea, or slight fever and malaise.

Discussion

Both 0.1 and 1.0 cc. of tetanus toxoid serve as effective recall doses, as shown by the increase in the antitoxin unitage in the two groups. With the former, a seven-fold and with the latter a thirty-two-fold increase occurred. A difference of this order would have been expected and is found to be statisti-

TABLE III

NUMBER AND PER CENT OF PERSONS WITH LOCAL OR GENERAL REACTIONS TO RECALL DOSE OF 0.1 AND 1.0 CC. OF TETANUS TOXOID

Reactions		Dose of tetanus toxoid			
		1.0 cc.		0.1 cc.	
		No.	%	No.	%
Local	None	29	45.3	64	76.2
	Slight	24	37.5	19	22.6
	Moderate	8	12.5	1	1.2
	Severe	3	4.7	0	0
General	None	58	90.5	75	98.8
	Slight	6	9.5	1	1.2

cally significant. A similar effect has been noted where large and small recall doses of diphtheria toxoid were used (1).

While the individual variation in response is very great, on the whole the results are most satisfactory. With the 1.0 cc. dose, 100 per cent of the group responded and had a titre of > 0.1 unit, all but one > 1 unit and 44, or 80 per cent, 10 units or $>$. Four of this group had less than a protective level of antitoxin (0.01 unit) prior to the recall dose and all responded to $> 1 < 10$ units. Since the rise in antitoxin following the recall dose is rapid (2) (3), prompt administration of tetanus toxoid in such individuals when indicated should confer protection. It would be preferable, of course, if possible, to prevent the occurrence of these low titres by adherence to a suitable schedule of re-immunization.

In those who received the 0.1 cc. dose the antitoxin response was less striking than in the 1.0 cc. group, with individual variation again a notable feature. Of the 67 in this group, at least 56 (83.6 per cent) responded. Among the 11 failures only 1 had less than the protective level of antitoxin (0.01 unit) while the others had goodly amounts. One individual with < 0.01 unit increased to 0.1 unit. With 1 exception, then, all of the 67 had 0.1 unit or greater subsequent to the recall dose and all but 3 (i.e. 95.5 per cent) had 1 unit or greater.

The failure of these 11 individuals to respond suggests that 0.1 cc. is a subminimal recall dose in some instances. This is of special importance in individuals, such as the one here, with little or no antitoxin where lack of response could be of serious consequence. Had there been more persons without initial antitoxin in this group, the effectiveness or otherwise of this small recall dose would have been more clearly revealed.

The above results are in substantial agreement with those of previous workers. Thus, Yeazell and Deamer (3) gave a recall dose of 0.5 cc. alum precipitated tetanus toxoid to 100 children who had received their primary course of immunization seventeen to forty-two months previously. Seven days later the antitoxin level was in excess of 0.3 units in all but 2 cases. In these 2 the antitoxin level was > 0.01 and > 0.03 unit respectively and represented at least a ten-fold increase. Fraser et al. (4) explored the effect

of a 0.1 cc. recall dose and under somewhat unfavourable conditions found 85 per cent of 20 individuals showing an increase in antitoxin nine days later. In a further group of 38 persons, 84 per cent showed a response to this dose at thirty days. After the administration of 0.5 cc. of the combined antigen of tetanus toxoid with typhoid vaccine (T.A.B.T.) as a recall dose in persons whose primary immunization consisted of T.A.B.T. or tetanus toxoid alone, 92 per cent of 168 persons had at least 0.1 unit of antitoxin per cc. of serum.

On the basis of reactions encountered, the 0.1 cc. is much superior to the 1.0 cc. dose. However, the reactions to the larger dose were seldom incapacitating and then only mildly so. Preliminary trials indicate that some further processing or refinement of the antigen largely circumvents the reaction problem. In the meantime, a dose somewhere between these two extremes which would balance the positive and negative factors of good antitoxin response and reactions, say 0.25 or 0.5 cc., seems to offer a reasonable compromise.

Another important feature relevant to selection of an adequate recall dose and the proper interval for its administration is the duration of the antitoxin response. This we plan to assess by a 3-year follow-up on these groups.

Summary and Conclusions

In a group of 67 young adults given a recall dose of 0.1 cc. (1 Lf) of tetanus toxoid, at least 83.6 per cent responded with an increase in antitoxin titre.

In a second group of 55 young adults given a recall dose of 1.0 cc. (10 Lf) of tetanus toxoid, 100 per cent responded.

The geometric mean of the antitoxin titres for the first group increased from 0.49 before to 3.66 units at 4 weeks after the recall dose. For the second group the increase was from 0.54 to 17.49 units. The values represent approximately a 7-fold and 32-fold increase respectively and the difference is found to be statistically significant. It is apparent that antitoxin production varied with, though not in direct proportion to, the strength of antigen employed.

While the 1 Lf recall dose was, in general, remarkably effective, the failure of 1 of 2 persons with < 0.01 unit to respond to this stimulus suggests that it might be less than adequate. The failure of 10 others with $> 1 < 10$ units to increase their titre strengthens this conclusion. Accordingly, in the light of present knowledge, the 10 Lf recall dose must be recommended though it is quite possible and likely that 5 Lf would be sufficient.

While local reactions to this larger dose were frequent, and general reactions, mild in nature, occurred in some 10 per cent of persons, they were not of a nature to serve as a contraindication to its use.

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The Public Health Nurse in the Tuberculosis Hospital

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THE modern public health nurse is to be found in a variety of services and in many differing backgrounds. Some people still think of her only in connection with official governmental and municipal health departments, but actually her services extend into many other health fields. We find her in our great visiting nurse organizations, in the ever increasing demands of industry, in Red Cross outposts, in private health and welfare agencies, in universities and other educational institutions, and in hospitals. At the moment we are concerned with her place in the tuberculosis hospital or sanatorium.

In addition to her basic three-year nursing course, the public health nurse has studied for at least a university year such subjects as principles of teaching, social work, nutrition, psychology, mental hygiene, and others related to her needs. Following this, we hope she has had the opportunity for experience in some community service which has brought her face to face with human problems, with individual personality and family maladjustments and with social backgrounds closely linked with the cause, cure and prevention of disease. She will thus have practical knowledge of the regulations and activities of the official health departments and of social, health, and welfare agencies; she will have practised team work in the interest of her patients. She will have, we trust, become acutely aware of *people,* not just lungs, hearts, spines or kidneys, and of the *person* as even more important than the disease.

The Patient

Now what of the patient—specifically the one in the tuberculosis hospital? What is his predicament?

First, he has a communicable disease which is one of the greatest social and health problems of the day. As Sir William Osler once said, "tuberculosis is a social problem with a medical aspect." The diagnosis has precipitated a crisis in the life of this patient and that of his family. The crisis is mainly social and economic, and produces the mental states of fear, worry, depression, irritability, frustration, etc. The very nature of the disease has necessitated a succession of new adjustments—separation from home and family, the routine of an institution, the change from individualized family living to that of impersonal group living—and all of this not just for a few weeks but for an indefinite period. He has plenty of time to worry, plenty of things to worry about. Again, to quote Sir William

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Osler: "What a patient with tuberculosis has in his head is more important than what he has in his chest."

The degree to which he adjusts to all this depends, not only on his own store of personality and courage, but also on how he is taught to understand himself and his disease, to do his part in treatment, and to plan a new way of life according to the extent of his handicap. Therefore his *education* is one of the most important aspects of his treatment.

His adjustment also depends on the understanding given to his emotional and social needs by those responsible for his treatment. He is not just a pair of lungs sent in for repair. He is an individual with a broken body and a disturbed mind. His thoughts are with his wife and children; he is seriously concerned about finances and about the family life so rudely upset by his admission to sanatorium. He needs much more than mere physical care.

The Service

Have I suggested two pictures to your mind—one, the patient and his need; the other, the public health nurse who has a definite service to give this patient?

From experience outside and within sanatoria and from observation of needs and services in a number of leading tuberculosis hospitals in Ontario and in several neighbouring states, I venture to suggest certain activities within the sanatorium which seem to call for a worker with the qualifications of an experienced public health nurse.

1. *As an Admitting Officer*

Admitting a new patient to a tuberculosis hospital involves much more than the filling out of a few forms. The importance of the initial interview and the patient's introduction to the hospital can hardly be overemphasized. He probably arrives anxious, bewildered, worried, fearful. The manner in which he is received, the atmosphere of the admitting room, the interest in him as a person, the understanding of his background and problems, can mean a great deal.

The step from home to sanatorium is not easy and the admitting room can provide a link of friendliness, of confidence in the treatment he will receive, and of hope, and thus provide a helpful beginning toward a successful cure.

This also is a good place and time to influence the family or friends who accompany the patient; to explain how they can best contribute to the patient's welfare, to answer their questions, to reassure them and to make a bid for their co-operation in the interest of the patient.

The admitting officer should be socially minded, should have sufficient medical knowledge to recognize varying degrees of illness and how to handle sick persons, should have an understanding of human problems and be interested in *people*. Of course, these qualities are not the exclusive possession of the public health nurse, but they are in her bag of tools.

2. *Patient Education*

Education of the patient is a primary function of the tuberculosis institution. One of the greatest obstacles to control of the disease will have been overcome when patients and their families thoroughly understand the facts about tuber-

culosis and apply what they have learned. Tremendous effort goes into the finding and treating of cases, yet all of this is wasted without the sustained cooperation of the infected individual. As "the person expelling the bacilli," he must learn of his responsibility to prevent spread; he must learn how to participate in his own treatment, for in the best medical opinion much of the success of the cure is up to the patient. His education should continue until an economically competent and self-disciplined individual has returned to his community and himself become an active participant in tuberculosis control.

While this teaching is the business of all who serve the tuberculous patient, there are opportunities for emphasis by a specially assigned worker at certain strategic points when the patient is most receptive—in the admitting department, at the bedside, by reading material and radio, and as preparation for discharge. As teaching is a primary function of the public health nurse, she seems to be a logical person to assist in this all-important aspect of treatment, and to give leadership and stimulus to others.

3. *Personal and Home Problems*

The public health nurse in sanatorium may assist in the adjustment of the patient and his family to the problem of tuberculosis, through an understanding of the mental, social, personality, occupational and economic problems involved in a long-term communicable disease, and in planning jointly with others concerned for dealing with these problems.

If the patient is anxious, worried, poorly adjusted and unhappy, learning and cooperation will not be attained. Tuberculosis causes relatively little physical pain but more than its share of mental distress. At the time of admission and as the months drag on, this very human aspect seems well worth consideration. Effort and time in order to get personal problems adjusted, are required. Some simple service rendered, perhaps a small matter in itself but a mountain in the mind of the patient, may well be the handle that opens the door to teaching opportunities or to the beginning of a good adjustment on the patient's part.

Be it understood that the public health nurse is not a social worker and does not do social case work. She can, however, be of value as a liaison officer in recognizing the problems that need the social case worker and in using her knowledge of community resources to link the service with the need. The writer has had many helpful contacts with social case workers of various agencies and is most appreciative of the services rendered to patients in whom she is interested.

4. *Rehabilitation*

To the uninitiated this word may sound vague and uninteresting but to those who have caught the vision of its possibilities, it is one of the most potent tools in the modern treatment of tuberculosis.

The fact that 25 per cent (or in some places as high as 50 per cent) of admissions to sanatoria are re-admissions seems to indicate that while our present methods of therapy have been successful in mending broken bodies, they have failed to adequately prepare our patients to meet the problems they will encounter in the workaday world. For economic reasons alone, we cannot afford this

wastage. Finding the open cases and providing adequate treatment have long been recognized as corner-stones of the control program, but it is only in recent years that the attempt has been made to prepare the patient to meet conditions of life and work which he must face after discharge. The ultimate aim of rehabilitation is to eliminate those conditions which bring about breakdowns and to establish the patient in a physically suitable occupation that will make him self-supporting.

The in-sanatorium aspect of rehabilitation begins very soon after admission. A sanatorium team is responsible for this service and must take into consideration the many-sided nature and complex life of the human being who is the patient. In the sanatorium best known to the writer, this group meets weekly under the chairmanship of the medical director, to consider new admissions, re-discussion cases, and those coming up for discharge. The public health nurse presents the picture of the patient as a person, his social background, family ties and human interests, all of which form a basis for understanding him and planning for his future. The patient's physician tells the medical side of the story, giving diagnosis, stage of disease and likelihood of recovery, and indicates the degree of study and occupational therapy in which this patient may engage. He also is able to forecast his probable work capacity on discharge; this is called Work Tolerance Prognosis and is a valuable guide for another member of our team, the vocational counsellor, who then is enabled to direct the patient's attention toward occupations for which he is likely to have the requisite strength and avoid those which might prove too arduous for him. Present also at this conference are the principal of the educational department and the directors of occupational therapy and of radio who will plan his activities, the superintendent of nurses who can relate knowledge gained to his daily care, and representatives of the Department of Veterans Affairs responsible for ex-service personnel. Occasionally a psychologist from a local mental health clinic is called in consultation, and quite often visiting doctors, public health nurses, social workers, and others are interested observers.

Time does not permit to enlarge upon the part played by these workers, but one would point out that the public health nurse here, as elsewhere, is not a lone worker but finds her fullest service in team work, in co-operation and co-ordination. To quote from the Manual of Public Health Nursing:

> "Public health nursing cannot be carried on successfully and productively as an isolated service. The more closely it is co-ordinated with the interests and activities of other related and co-operating agencies through a constant sharing and interchange of ideas and services, the more soundly and economically will it fulfil its purpose."

Her efforts do not overlap, but dovetail throughout with those of other members of the rehabilitation team as from time to time it is necessary to reconsider and give attention to recurring problems and changing patterns in the life of the patient.

Rehabilitation helps improve patient morale. Each day is not just another in a number of pointless days but is a day with an interest and a purpose, mental exercise compensating for physical inactivity which is an important factor in restoration to health. And it puts new life into the staff, leads to a broader out-

look, makes everyone brush up on principles and "brings an inner glow to all identified with the work."

5. *Helping to Meet Staff Needs*

So far we have dealt with the service which the public health nurse may give to the patient within the sanatorium. Another whole field opens up when one considers her possible contribution to staff needs. Staff education on all levels, professional, auxiliary and lay; health supervision of staff; participation in post-graduate and student courses—all are of vital importance in a communicable disease hospital, and in such programs the public health nurse may reasonably take a modest part. Even volunteer visiting groups can do with some instruction and guidance.

Scope and Opportunity

The deeper one gets into this game and the more one thinks about it, the more it becomes evident that it is not a case of looking for opportunities but merely of trying to touch the high spots. Suggestions as noted above are far beyond the time capacity of any one person and also involve considerable clerical work for which adequate help is required.

In closing one would like to acknowledge inspiration and helpful ideas from colleagues in various sanatoria; to Toronto Hospital, Weston, which has demonstrated a helpful admitting room set-up; to Lowman Pavilion of Cleveland City H spital for leadership in patient education, aseptic techniques and student affiliations; to Queen Alexandra Sanatorium in London, Sunny Acres in Ohio and Niagara Sanatorium in New York State, for ideas and inspiration on rehabilitation; to Herman Kiefer Hospital in Detroit for special reference to the use of public health nurses within a tuberculosis hospital; and to the late Dr. C. H. Playfair for an unusual degree of understanding, inspiration and leadership during the writer's experience of a developing program in Mountain Sanatorium at Hamilton.

The teaching function of the public health nurse should permeate all her work. The patient in the tuberculosis hospital offers her one of her greatest opportunities, not only for his own sake but also because of his potential influence in his circle of family and friends.

To quote Dr. Trudeau:

"In tuberculosis the first and greatest need is education; education of the people and through them education of the state."

Salmonella Typing in Ontario and the Use of Polyvalent Antisera

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IN October, 1934, the Kauffmann-White Schema showing the antigenic structure of the *Salmonella* group was recognized by the Salmonella Subcommittee of Nomenclature of the International Society of Microbiologists (1). In 1934 immediately following its publication a group of *Salmonella* cultures were obtained by us from the National Type Culture Collection at the Lister Institute, London, England. These cultures represented the antigenic factors of the *Salmonella* group that had been recognized up to that time. From these cultures antisera were prepared for the "O" and specific and non-specific "H" antigens.

At that time the only monophasic strains of diphasic types available were non-specific phase variants. Serum prepared from one of them—the Kuntzendorf strain of *S. cholerae-suis*—was used for phase identification. This necessitated the continuous selection and testing of colonies against Kuntzendorf antiserum until the desired phase was isolated; and even though the antigen prepared from these selected colonies appeared to contain only the one phase, antiserum prepared from it might contain agglutinins for both phases, so that it would require absorption before it could be used for diagnostic purposes. We were very fortunate in the first batch of *S. paratyphi B* specific serum which we had prepared from a diphasic strain, as when it was tested the specific phase titre was 25,000 and the non-specific only 100.

As new types were incorporated into the Schema, other cultures were added to our stock strains for the preparation of antiserum for the new antigenic factors. These cultures were obtained from the Lister Institute, and more recently by the kindness of Dr. P. R. Edwards of the National Salmonella Centre, Lexington, Kentucky.

Since 1934 a total of 2,816 *Salmonella* cultures have been identified at these Laboratories. Of these, 87 were received from the United States in 1939 and 1940. Of the remainder, 1,375 were received between January 1935 and January 1944, and 1,441 in the period from January 1944 to November 1947.

Prior to 1944 the types identified included *Salmonella typhi, paratyphi B, typhimurium, newport, brandenburg, bareilly, enteritidis, cholerae-suis, paratyphi C* and *virchow.*

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The purpose of this paper, however, is to report those *Salmonellae* identified from January 1944 up to the present time.

TABLE I

NUMBER OF *Salmonella* TYPES IDENTIFIED—1944 to 1947

Salmonella	1944		1945		1946		1947 (10 months)	
	Number cultures	Number sources	Number cultures	Number sources	Number cultures	Number sources	Number cultures	Number sources
paratyphi A	..	..	1	1	..	..	..	..
paratyphi B	26	17	72	39	127	52	55	19
typhimurium	45	36	55	36	82	71	82	79
reading	..	..	..	..	..	..	1	1
derby	2	2	..	..	1	1	1	1
brandenburg	1	1	..	..	..	..	..	..
bredeney	4	4	10	5	6	6	2	1
paratyphi C	1	1	..	..	..	..	..	..
cholerae-suis	15	11	..	..	6	2	..	..
thompson	..	..	..	..	2	2	2	2
oranienburg	1	1	1	1	11	9	7	6
potsdam	..	..	1	1	2	2	1	1
bareilly	4	4	2	2	18	4	4	4
montevideo	2	2	..	..	1	1	1	1
tennessee	..	..	..	..	2	2	..	..
newport	38	34	25	12	33	22	6	6
manhattan	..	..	1	1	..	..	..	..
bonariensis	..	..	..	..	2	2	..	..
typhi	120	60	117	80	156	101	250	103
enteritidis	..	..	5	1	4	4	14	9
moscow	1	1	..	..	..	..	..	..
pullorum	..	..	..	..	..	..	1	1
anatum	..	..	..	..	..	..	5	5
newington	..	..	1	1	..	..	..	..
senftenberg	..	..	1	1	2	2	1	1
minnesota	1	1	..	..	..	..	..	..

In that period 27 types of *Salmonella* have been indentified. Of these, *Salmonella tennessee, anatum, reading and bonariensis* were of animal origin. *Salmonella enteritidis, montevideo, cholerae-suis, typhimurium, paratyphi B* and *oranienburg* were identified from both man and animals. The remaining 17 types were of human origin.

S. typhimurium was identified from swine, cattle, cheese, pigeons and from mink. In addition to *Salmonella typhimurium, Salmonella anatum, enteritidis* and *paratyphi B* have also been obtained from mink. *Salmonella bonariensis, tennessee, montevideo* and *reading* were identified from chickens, and *Salmonella oranienburg*, from eggs.

All the *Salmonella cholerae-suis* cultures identified in 1944 were isolated from swine. They were hydrogen-sulphide positive and showed both phases to be present without resort to the Gard technique for isolation of suppressed phases. Those isolated in 1946 were from summer sausage and from the faeces of one of the patients. These strains were also hydrogen-sulphide positive, but the specific phase was isolated with difficulty by the Gard technique.

Double and even multiple *Salmonella* infections in man and animals are not uncommon, and have been reported in the literature (2). At these Laboratories in 1946 *Salmonella thompson* and *potsdam* were both isolated from the faeces of a patient suffering from gastroenteritis and in the same year *Salmonella paratyphi B* and *potsdam* were obtained simultaneously from a stool specimen. In 1945, *Salmonella paratyphi B* and *newport* were both isolated a number of times from the stool specimens of a hospitalized patient. In 1947 the faeces of a patient showed the presence of *Salmonella typhi* and *paratyphi B* and in the same year *Salmonella typhi* and *Shigella paradysenteria Flexner* were obtained from the same stool specimen. Consequently it does not appear to us to be sufficient to identify a single colony isolation, so a number of typical colonies are selected and the identity of all of them is established.

As the *Salmonella* group of organisms grew in numbers and antigenic complexity, it became increasingly evident that some method for rapid differentiation between *Salmonella* organisms and those isolations of doubtful pathogenicity but with similar biochemical reactions must be found. Such a method would enable us to send out a preliminary report of the presence of an organism of the *Salmonella* group which could be followed up later by a final identification, when an antigenic analysis had been completed.

In 1942 Kauffmann advocated the use of multivalent sera for the rapid identification of *Salmonella* cultures. A polyvalent anti-*Salmonella* serum was prepared by Bruner and used by the 15th Medical General Laboratory of the United States Army in 1944-45 (4).

In 1945-46 polyvalent *Salmonella* antisera were prepared in the Section of Enteric Diseases of the Ontario Department of Health Laboratories. The method used by Kauffmann in the grouping of antigens and the preparation of antiserum was followed as closely as possible. Four pools of "O" antigens and four pools of "H" antigens were prepared. The grouping of these antigens is shown in Tables II and III.

TABLE II

"O" Antigen Groups for the Preparation of Antiserum

O.A.	O.B.	O.C.	O.D.
I, II, XII	VI, VII	XVI	XXXV
IV, V, XII	VI, VIII	XVII	XXXVIII
IX, XII	XI	XVIII	XXXIX
III, X, XXVI	XIII, XXII	XXVIII	
I, III, XIX	VI, XIV, XXIV	XXIX	
XXI, XXVI	(VIII), XX	XXX	
IV, XXVII, XII			

In order to avoid confusing cross-agglutination as much as possible, antigens that have a factor or factors in common have been placed in the same group. Thus the O.A. group contains all those antigens which have I, IV, III or XII; the O.B. group contains those antigens that have the VI factor in common. The somatic antigens of *Salmonella typhi, paratyphi A, paratyphi B, typhimurium* and *enteritidis* should be agglutinated by the serum prepared

from the O.A. antigen pool, whereas the "O" antigens of *Salmonella newport, oranienburg* and *bareilly* should be agglutinated by the serum prepared from the O.B. antigen, to name only a few of the more frequently isolated types. In groups O.C. and O.D. are those types that are isolated only occasionally.

TABLE III

"H" ANTIGEN GROUPS FOR THE PREPARATION OF ANTISERUM

H.A.	a; b; b, z_{12}; c; d; i; z_{14}
H.B.	e, h; g, m; f, g; m, t; z_{29}; z_{27}; e, n, z_{15}; z_{10}
H.C.	k; l, v; r; y; z; z_4, z_{23}; l, w; z_4, z_{24}
H.D.	1, 2; 1, 2, 3; 1, 5; 1, 6; 1, 7

Table III shows the flagella antigen pools. In H.A. are the "b" and "i" factors of *Salmonella paratyphi B* and *typhimurium*, respectively, as well as the "c" antigen of *Salmonella cholerae-suis* and the "d" antigen of *Salmonella stanley*. In the H.B. group is the "e" factor common to the phase 1, "e, h" antigen of a number of *Salmonella* types and to the "e, n, x" and "e, n, z_{15}" 2nd phase antigens; this is pooled with that group of *Salmonellae* which have the factors "g, m" or both. The most frequently isolated types contained in group H.C. have been *Salmonella bredeney* (*l, v*), *bareilly* (*y*) and *thompson* (*k*). H.D. is a non-specific phase group.

Since the serological properties of the "O" antigen of rough (R) strains are not the same as those of the smooth (S) cultures from which they are derived, all cultures used in the preparation of the somatic antigens for injection into rabbits were carefully examined for any signs of rough variation. For the preparation of the inoculum, each culture was grown on one 9″ tube of soluble starch agar for 20 hours at 37° C. The growth from each slant was suspended in 2.0 cc. of 0.85 per cent salt solution, and steamed for 2½ hours at 100° C. Formalin, (0.2 per cent) was added as a preservative.

The suspensions were standardized to the same density, and equal volumes of the cultures for each group were combined. For injection the inoculum was so diluted that 0.5 cc. contained the dose. The number of organisms in each dose was equivalent to 0.25, 0.5, 1, 2, 3, 4, 5 and 6 cc. of a 20-hour broth culture of *S. paratyphi B*. The doses were given at intervals of 4 days. Eight days after the last dose the animals were bled, and the serum preserved with 0.01 per cent merthiolate and stored in the cold room.

In preparing the "H" polyvalent antisera, every precaution was taken to reduce undesirable cross-reactions to a minimum, so that they would contain only antibody for the specified phase. This is not always possible when only diphasic organisms are available. We are indebted to Dr. Edwards (5) for the number of monophasic variants of diphasic types that are now available for the preparation of specific antisera. Where only diphasic cultures were procurable, a modification of the Gard technique was used for the isolation of the desired phase.

The cultures for the preparation of the "H" inoculum were passed through semi-solid agar two or three times to ensure the maximum development of the "H" antigens. They were grown on veal infusion agar for 20 hours at 38° C. The growth from each slant was suspended in 1 per cent formalin saline. Before the suspensions were pooled, they were retested gainst specific antisera as a further check on possible phase changes. The doses and method used in preparing the "H" antisera were the same as for preparing the "O" sera.

The polyvalent "H" and "O" sera were then tested for specific antibodies and for any undesirable cross-agglutinations. Formalinized broth cultures were used for testing the polyvalent "H" sera by tube agglutination. For testing the "O" sera the antigen was prepared by the method advocated by White (1926) and by Edwards (1942), and slide agglutination was used. The results of these tests are shown in Tables IV and V.

TABLE IV

AGGLUTINATION OF SOMATIC ANTIGENS IN POLYVALENT "O" ANTISERA

Somatic Antigens	Polyvalent "O" Sera				Somatic Antigens	Polyvalent "O" Sera			
	OA	OB	OC	OD		OA	OB	OC	OD
I, II, XII	++++	−	−	−	XVI	−	−	++++	−
IV, V, XII	++++	−	−	−	XVII	−	−	+++	−
IX, XII	++++	−	−	−	XVIII	−	−	++++	−
III, X, XXVI	++++	−	−	−	XXVIII	−	−	++++	∓
I, III, XIX,	++++	−	−	−	XXIX	−	−	++++	−
XXI, XXVI	++++	−	−	−	XXX	−	−	++++	−
IV, XXVII, XII	++++	−	−	−					
VI,VII	−	++++	−	−	XXXV	−	−	−	+++
VI, VIII	−	++++	−	−	XXXVIII	−	−	−	+++
XI	−	++++	−	−	XXXIX	−	−	−	+++
XIII, XXII	−	++++	−	−					
VI, XIV, XXIV	−	++++	−	−					
(VIII), XX	−	++++	−	−					

The polyvalent "O" sera agglutinated strongly all those antigens included in the inoculum. Only one slight cross-reaction was noted.

TABLE V

AGGLUTINATION OF FLAGELLA ANTIGENS IN POLYVALENT "H" ANTISERA

Flagella Antigens	Polyvalent "H" Sera				Flagella Antigens	Polyvalent "H" Sera			
	HA	HB	HC	H D		HA	HB	HC	HD
a	++++	+	+	−	k	−	−	++++	−
b	++++	−	−	−	1, v	−	−	++++	+
b, z_{12}	++++	−	−	−	1, w	−	−	++++	−
c	++++	−	−	−	r	−	−	++++	−
d	++++	−	−	−	y	−	−	++++	−
i	++++	+	−	−	z	−	−	++++	−
z_{14}	++++	−	−	−	z_4, z_{23}	−	−	++++	−
					z_4, z_{24}	−	−	++++	+
e, h	+	++++	+	−	1, 2	−	−	−	++++
g, m	−	++++	−	−	1, 2, 3	−	++	±	++++
f, g	−	++++	−	−	1, 5	±	−	±	++++
m, t	−	++++	−	−	1, 6	−	−	−	++++
z_{29}	−	++++	±	±	1, 7	−	−	−	++++
z_{37}	−	++++	±	−					
e, n, z_{15}	−	++++	−	−					
z_{10}	−	++++	−	−					

The polyvalent "H" sera also agglutinated strongly all antigens included in the inoculum. Only very slight cross-reactions were observed, with one exception. This was due to some e, h antigen in the culture with which the serum was tested.

All cultures suspected of belonging to the *Salmonella* group are screened through these polyvalent sera.

"O" antigens are prepared from the suspected cultures by White's method and tested by slide agglutination against the four polyvalent "O" sera. "H" antigens are prepared from 18 to 24 hour broth cultures diluted with an equal volume of 0.6 per cent formalinized saline. The latter tests are incubated for 1 hour and then read. If the culture is actively motile, flocculation will take place within a few minutes. No "O" agglutination will be apparent after so short an incubation period.

Three hundred and thirty-three cultures have been screened through these eight polyvalent sera.

The cultures in Table VI are grouped according to the results obtained in polyvalent "H" sera. For instance, *S. paratyphi B* isolations are divided into three groups:

1. Those that showed only one phase when first isolated, but from which the suppressed phase was isolated by a modification of the Gard technique.

2. Those in which both phases could be demonstrated immediately upon isolation.

3. Monophasic types, from which the second phase, so far, has not been obtained, even after repeated subculture in specific antiserum.

The asterisk indicates the phase which could not be demonstrated when the culture was first isolated but which was isolated later by a modification of the Gard technique.

Cultures which were agglutinated by polyvalent "H" and "O" antisera were reported as organisms of the *Salmonella* group. Final identification was made using specific and single factor absorbed sera.

The types in the O.C. group appear to be quite rare, but Ranta and Dolman (6) reported the identification of 2 cultures of *Salmonella urbana* isolated in Quebec in December, 1946.

Three cultures, which were agglutinated by O.D. serum, proved to be members of the paracolon group—two having *Salmonella* somatic antigen XXXVIII, and one with XXXV. Paracolon cultures with somatic antigens related to the *Salmonella* group were reported by Peluffo, Edwards and Bruner in 1942 (7), by Edwards, Cherry and Bruner in 1943 (8), and by Young in 1946 (9). Seventy-six other paracolon cultures showed no agglutination in polyvalent *Salmonella* "H" and "O" sera.

Only one culture which failed to agglutinate in polyvalent serum was later proved to be a *Salmonella*.* This culture when it was received was

*This culture has since been identified as *Salmonella kirkee*.

NOTE: With the exception of the *S. cholerae-suis* strains isolated in 1946, all the cultures of animal origin were received from the Ontario Veterinary College, Guelph, Ontario.

TABLE VI

THE RESULTS OBTAINED WITH 333 ISOLATIONS IN POLYVALENT ANTISERUM

Salmonella Type	No.	Polyvalent "O" Antisera				Polyvalent "H" Antisera				Single factors identified by specific and absorbed sera		
		OA	OB	OC	OD	HA	HB	HC	HD	"O"	"H" phase 1	"H" phase 2
paratyphi B	59	++++	−	−	−	++++	−	−	−	[I], IV, [V], XII	b	1, 2*
paratyphi B	7	++++	−	−	−	++++	−	−	++++	[I], IV, [V], XII	b	1, 2
paratyphi B	4	++++	−	−	−	++++	−	−	−	[I], IV, [V], XII	b	—
typhimurium	88	++++	−	−	−	++++	−	−	−	[I], IV, V, XII	i	1, 2, 3*
typhimurium	27	++++	−	−	−	++++	−	−	+++	[I], IV, V, XII	i	1, 2, 3,
reading	1	++++	−	−	−	−	++++	−	−	IV, XII	e, h	1, 5*
bredeney	3	++++	−	−	−	−	−	+	++++	IV, [XXVII], XII	1, v*	1, 7
cholerae-suis	6	−	++++	−	−	±	−	−	++++	VI, VII	c*	1, 5
thompson	1	−	++++	−	−	−	−	++++	++++	VI, VII	k	1, 5
thompson	2	−	++++	−	−	−	−	++++	−	VI, VII	k	—
oranienburg	11	−	++++	−	−	−	++++	−	−	VI, VII	m, t	—
potsdam	2	−	++++	−	−	−	++++	−	−	VI, VII	1, v	e, n, z_{15}
bareilly	8	−	++++	−	−	−	−	++++	+++	VI, VII	y	1, 5
bareilly	4	−	++++	−	−	−	−	++++	−	VI, VII	y	1, 5*
montevideo	2	−	++++	−	−	−	++++	−	−	VI, VII	g, m, s	—
newport	7	−	++++	−	−	−	++++	−	−	VI, VIII	e, h	1, 2, 3*
newport	4	−	++++	−	−	−	++++	−	++++	VI, VIII	e, h	1, 2, 3
enteritidis	12	++++	−	−	−	−	++++	−	−	IX, XII	g, m	—
pullorum	1	++++	−	−	−	−	−	−	−	IX, XII	—	—
anatum	5	++++	−	−	−	−	++++	−	−	III, X, XXVI	e, h	1, 6*
paracolon	76	−	−	−	−	−	−	−	−	—	—	—
group	2	−	−	−	++++	−	−	−	−	XXXVIII	—	—
	1	−	−	−	++++	−	−	−	−	XXXV	—	—

rough and non-motile. The biochemical reactions, however, were quite typical. After subculturing on soluble starch agar and motility tubes, a smooth motile culture was obtained. Such cultures are extremely rare.

Summary

Salmonella typing by the Kauffmann-White Schema has been carried out at these Laboratories since 1935. In that time 27 different types have been identified. In 1945, 8 polyvalent *Salmonella* sera were prepared following a modification of Kauffmann's procedure. All cultures suspected of being species of *Salmonella* are screened through these polyvalent sera, which permits an early preliminary report of *Salmonella* isolations. This is followed later by a final identification when an antigenic analysis has been completed.

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A Survey of Pinworm Infection in an Elementary School

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IT is perhaps surprising that an infection as general as that of the common pinworm should be diagnosed so seldom in medical practice and that so little should be known of its significance in terms of human health. The following is a brief account of an investigation into the degree of infection of a group of elementary school children which should serve to emphasize further the prevalence of infection.

The public health nurse in the area had many and repeated reports from mothers concerning minor symptoms attributed to the presence of pinworms (*Oxyuris vermicularis*) in one or more members of the family. To obtain a clearer picture of the local situation, it was decided to examine as many children as possible in the central elementary school with an enrolment of 160 children in grades one to six. The school is located in a village, but many children come from rural areas within a radius of about two and one-half miles.

Examination

After consent had been obtained from the parents, 124 children were examined at the school in the first group. One Graham swab consisting of three inches of "Scotch tape" held sticky side outwards over the end of an applicator was used by the doctor or the public health nurse, care being taken to flatten out the peri-anal folds and to apply the swab to both sides of the mid line. The swab was later dipped in a dilute iodine solution and applied sticky side down on a glass slide for microscopic examination. These swabs were collected during both forenoon and afternoon, so that many were tested far from the optimum time of day.

At a later date 21 other children were checked by sending the swab home in a test-tube and having the mother apply it to the peri-anal region early in the morning. Most of the remaining children not examined were omitted because the parents had recently seen pinworms and wished the children to be spared any embarrassment.

Tabulation of Findings

In the tabulation of our results, there are listed as "known positive" those children whose parents reported seeing pinworms immediately before or during the investigation. Of the 21 children in this group, 9 showed no ova on the single swab test.

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Table I shows the grouping of the 160 children enrolled at the school. We have either one examination or a positive report on all except three children.

From Table II it is seen that 38 children were found positive on examination, and 21 others are added as "known positive," making a total of 59 cases, or 37.6 per cent of the 157 children known or examined.

Table III shows the duration of residence in this area of all 116 families represented in this school and, for comparison, that of the 46 families with pinworm infection. The median length of residence of the positive families is only two years.

Table IV reveals that the apparent incidence of infection is highest in grades II and III, with 50 per cent positive, and decreases at grades V and VI to only 21 per cent. Many other factors might affect this figure, but the difference is rather great.

A spot map was also made to determine the geographical distribution of the positive cases in relation to that of the other school children. This showed a distribution of cases throughout the area comparable to that of the general school population.

Home Visits

The most time-consuming part of the investigation came after the examinations, when the public health nurse visited each of the 46 homes with positive cases in order to report findings and explain methods of control and treatment. The parents were most appreciative and co-operative and provided many interesting sidelights on oxyuriasis. Previous symptoms attributed to pinworms ranged from convulsions and coma in one small child, through abdominal cramps, pains, nausea, restlessness, poor sleep, anorexia and underweight, to simple "pruritus ani" in an adult.

The treatment recommended after discussion with the local physicians consisted of 3/20 gr. or ½ gr. gentian violet enteric-coated tablets thrice daily in standard dosage in two eight-day series one week apart. In every instance it was recommended that the whole family be treated and in most families this was done with very few complaints of nausea or diarrhoea. In addition, quassia enemas and ammoniated mercury ointment were used in some cases, along with boiling of underwear and bedding to prevent re-infection.

Observations

TABLE I

ELEMENTARY SCHOOL EXAMINATION

First group examined	124	Found positive	30
Second " "	21	" "	8
Total	145	Total	38
Not examined	15	(no record of 3)	
Total enrolment	160		

TABLE II

POSITIVE CASES

Found positive on examination (5 previously known)	38
Known positive but not examined	12
Known positive but not found on examination	9
Total positive cases	59 (37.6%)

TABLE III

LENGTH OF RESIDENCE IN DISTRICT BY FAMILIES

Residence	Under .5	.5—.9	1—1.4	1.5—2.9	3—4.9	5—9.9	10 years and over	Total
Positive families	5	6	5	8	6	9	7	46
Negative families	5	8	9	8	8	9	23	70
Total	10	14	14	16	14	18	30	116

TABLE IV

INFECTION STATUS OF CHILDREN BY CLASSROOM

DIVISION Grades	I 5—6	II 4—5	III 3—4	IV 2—3	V 1	TOTAL
No record	0	0	1	1	1	3
Negative	22	20	19	16	21	98
Found positive	3	9	8	10	8	38
Known positive	3	3	5	6	4	21
Total children	28	32	33	33	34	160
Per cent positive	21.0	37.5	40.5	50.0	36.0	37.6

(a) The positive cases were found in every type of family—from one to many children, from extremes of economic status, from rural homes to crowded auto-camps, and from the very well cared for to the most neglected.

(b) The short time of residence in the area of most of these families, and the diversity of places from which many had recently come, suggests that similar results might be found from an investigation anywhere in the province.

(c) Many minor symptoms are attributed to infection with pinworms, and perhaps rightly so, but many children and adults alike reported no definite complaints.

(d) As many of these children had been treated previously, either treatment as generally employed is rather ineffective or reinfection from within or outside the family soon occurs.

(e) The younger school children have a higher incidence of infection than the older children.

(f) Reports in recent journals would suggest that our findings are in no way unusual and that 37.6 per cent known positive cases would indicate a probable incidence of about 50 per cent.

(g) Much remains to be learned about the importance of oxyuriasis as a health problem, and about effective methods of control.

SUMMARY

A brief report of a pinworm survey in an elementary school has been presented indicating a high prevalence of infection in school children generally.

Plate Techniques for the Assay of Subtilin

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A TURBIDIMETRIC assay for subtilin, based on McMahan's assay for penicillin (1), has been described by Lewis and co-workers (2) of the Western Regional Research Laboratories. In general, turbidimetric methods have obvious drawbacks for large numbers of routine tests, as they are laborious to set up and cannot be read without an accurate turbidimeter. The periods of incubation in the methods proposed by Lewis are 4 hours for 2 of the organisms and 5 hours for a third. It is only with difficulty that any number of assays can be completed in an 8-hour day by these methods. Furthermore, Lewis suggests that the subtilin is bound to less diffusible, antibiotically inert substances and that this renders it unsatisfactory for cup plate assay. As anticipated by him, preliminary experiments showed that zones of negligible size were produced when solutions of fairly high concentration were added to plates in the usual way. Such a result could be explained by slow diffusion or by destruction of the antibiotic under the conditions of the test. Incubation at lower temperatures was considered to be a means of overcoming both these difficulties. However, incubation for 24 hours at room temperature produced only slightly larger zones. As Dimick (3) had shown that 94 per cent of the activity was retained when dilute solutions at pH 6.5 were stored at room temperature for 20 hours, destruction of the antibiotic was tentatively ruled out as a possible source of failure to obtain zones. On the assumption that the rate of diffusion was too slow to prevent the multiplication of the rapidly growing organism, experiments were undertaken to achieve a more useful balance between these factors.

Materials

Culture

The test organism was *Staphylococcus aureus* 209P. An overnight culture was prepared daily in a tryptic digest of beef. This medium gave a smooth suspension of organisms.

Preparation of the plates

Medium for the base layer was prepared according to the following formula: 0.5 per cent Peptone (Difco proteose), 0.3 per cent Yeast extract (Difco), 0.15 per cent Beef extract (Difco), 0.1 per cent Glucose, 2.0 per cent Agar. Final pH 6.5—6.6. Twenty-one ml. were measured by pipette into sterile flat-bottomed petri dishes and allowed to solidify.

Presented at the fifteenth annual Christmas meeting of the Laboratory Section, Canadian Public Health Association, held in the Royal York Hotel, Toronto, December 15 and 16, 1947.

Medium for the seed layer was prepared by the same formula with the exception that only 1 per cent agar was added. This was sterilized in 200 ml. volumes. To prepare a flask for seeding, the agar was melted, cooled to 50° C. and 4.5 ml. of the overnight culture added. After thorough mixing, 4 ml. of the suspension were added to each plate and distributed evenly over the surface.

Standard

A sample of partially purified subtilin, received from Dr. Salle, was used as a standard in all cases. An arbitrary unitage was assigned to it (see Footnote).

Solutions

All the samples, including the standard, were dissolved in dilute hydrochloric acid—pH 2.5. The unknowns were lyophilized samples chosen from different stages in the process of purification of culture extracts. The standard was prepared by dissolving 6 mg. in 100 ml. of dilute HCl and making 1:2 and 1:4 dilutions of this, giving solutions containing 100 u/ml., 50 u/ml. and 25 u/ml. Two dilutions of the unknown were prepared, which would contain concentrations in the same range as the standards, the one being twice the concentration of the other.

Experimental

Method

Early experiments showed that a relatively long period of diffusion must be allowed before growth of the organism is initiated. Five cups were placed on the plates, three filled with the three solutions of standard and two with the two solutions of the unknown. The plates were then placed in the refrigerator. It was found that preliminary refrigeration of 20 hours followed by overnight incubation at room temperature gave zones of perfect clarity and satisfactory size. The results obtained in such preliminary experiments are illustrated in the photograph.

The log of the concentration was found to be a linear function of the diameters of the zones of inhibition. For doubling the concentration, a difference in zone diameter of 2.8 mm. was obtained.

Method 2

Method 1 has the disadvantage that it takes 36 hours before the plates can be read. Dufrenoy and Pratt have published a series of papers on the cytochemical action of penicillin. They have demonstrated (4) that before readable zones appear, a state of oxidation exists around the cylinders, while a state of reduction exists in the body of the plate. By the use of certain

A unit of subtilin has been defined as that amount present in 1 ml. of the highest dilution capable of killing *Staphylococcus aureus* in 10 minutes at 37° C. by the FDA phenol coefficient test. For our tests it seemed more expedient to define a new unit as that amount per ml. which would give a curve, ranging from zero to complete inhibition in Lewis's turbidimetric method with *Staph. aureus* 209P. This amount could be more readily determined by us. On this basis, a potency of 1667 units per mg. was assigned to Dr. Salle's preparation.

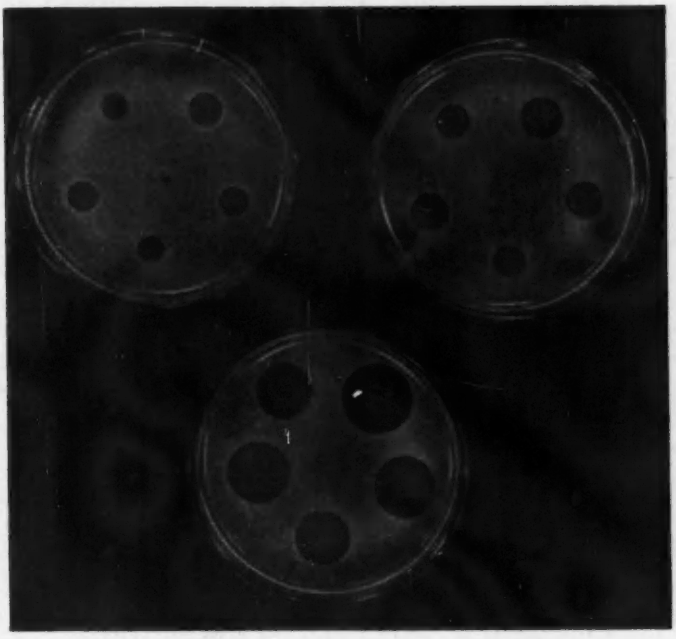

FIGURE 1

The plate in the upper left-hand corner was incubated overnight at 37°C. The one at the upper right was incubated overnight at room temperature. The lower one was refrigerated for 20 hours, followed by incubation at room temperature for 16 hours. The same solutions were used on all three plates.

chemicals (5), these differences in oxidation-reduction potential resulting from changes in metabolism can be detected before zones of inhibition are visible to the naked eye. We found that similar changes were taking place in the *Staph. aureus* under the action of subtilin. Plates prepared as in Method 1 were refrigerated for 20 hours and then incubated at 37° C. for 6 hours. They were flooded with 2 ml. of a 1 per cent solution of ferric sulphate, allowed to stand for 2 minutes, drained, and flooded with 2 ml. of a 2 per cent solution of potassium ferricyanide. After two to three minutes sharp zones were produced. The zones remained uncoloured or developed a slight greenish tinge while the remainder of the plate became first green and on standing turned dark blue. The chemicals are now routinely added in the reverse order to that suggested by Dufrenoy and Pratt. Although no difference in the diameters of the zones can be detected, we find that less precipitate is deposited on the plates. A linear relationship between the log of the concentration and the zone diameters was again obtained, the difference in zones being 2.0 mm. for doubling the concentration.

As a result of these experiments it appeared that either of these methods would form a useful basis for plate assaying of subtilin.

Nine samples were chosen for extensive comparison between these two cup plate methods and two of the broth methods proposed by Lewis. One of these latter consisted of a 4-hour test using *Staph. aureus* 209P as the test organism and the other a 5-hour test with *M. conglomeratus* (Merck's MY strain). Each sample was assayed at least 4 times by each of the 4 methods. The results are shown in Table I.

It can be seen that the plate methods give results higher than those from the broth methods except in the case of 43B. This was the only sample prepared in synthetic medium. The difference in results amounts to 14—20 per cent. We are at a loss to explain this difference but feel that it is impossible to say which method gives the more accurate result until pure subtilin can be obtained for a reference standard.

By a simple analysis of variance, using all the observations for each method, it was found that the experimental error (the within-sample variation) was as shown in Table I.

TABLE I

COMPARISON OF RESULTS OBTAINED BY PLATE METHODS I & II AND BY TURBIDIMETRIC ASSAYS

Sample Number	Cup Plate Assay Refrigerated 20 hours		Turbidimetric Assay	
	Incubated 16 hours at R.T.	Incubated 6 hours at 37° C.	*S. aureus*	*M. conglom.*
40A	399	464	354	365
42A	555	507	444	470
45A	464	447	358	404
43B	297	300	299	319
29B	1147	1017	836	905
44B	1005	940	765	814
12C	1016	985	894	882
28C	1155	1139	1012	1139
21C	652	757	675	707
Within Sample Variation	10.9%	13.9%	10.7%	18.8%

Each figure is an average of at least four determinations. These assays are expressed in units per mg., measured in terms of a partially purified sample of subtilin to which an arbitrary unitage of 1667 units per mg. was assigned.

Method 3

Experiments were later undertaken to determine whether the cups could be replaced by filter paper discs. The cups made difficult the excessive handling of the plates. Unfortunately, the same concentrations which gave zones with the cups failed to show inhibition with discs on the same medium. However, zones were produced when 0.1 per cent Tween 80 was added to the seed layer. The effect of Tween 80 in both the medium and the diluent is shown in Table II. It can be seen that the presence of Tween 80 in either

TABLE II

EFFECT OF TWEEN 80 IN THE MEDIUM AND IN THE DILUENT ON THE SIZE OF THE ZONES OF INHIBITION

Medium in Seed Layer	Diluent	Diameters of the zones of inhibition in mm.			
		50 u/ml.	100 u/ml.	200 u/ml.	400 u/ml.
Regular	Dilute HCl	....	....	19.1	25.1
Regular	Dilute HCl + 0.1% Tween 80	17.4	21.3	25.4	28.8
Regular + 0.1% Tween 80	Dilute HCl	17.1	21.4	25.4	29.2
Regular + 0.1% Tween 80	Dilute HCl + 0.1% Tween 80	19.3	22.8	26.4	29.7

the medium or the diluent greatly increases the size of the zones. The concentration of agar in the seed layer was increased to 2 per cent. Standard solutions containing 200 u/ml., 100 u/ml. and 50 u/ml. were used as reference. The technique of Loo (6) for the use of filter paper dics (Schleicher and Schuell 740E) was followed with 0.08 ml. on each disc. Development of the zones after 6 hours' incubation was carried out as in Method 2. The slope of the dosage-response curve is greater than that with the cups, a difference of 3.5-4.0 mm. being obtained for doubling the concentration.

A second group of nine samples was selected for comparative tests. They were assayed four times by the disc plate method and by the same broth methods as used before. The averages of the results are shown in Table III with the experimental error found in each method.

TABLE III

COMPARISON OF RESULTS OBTAINED BY PLATE METHOD III AND BY TURBIDIMETRIC ASSAYS

Sample Number	Disc Plate Assay	Turbidimetric Assay	
		S. aureus	*M. conglom.*
80A-1	402	315	398
82A-1	258	252	270
86A	140	170	208
78B-1	739	798	688
80B-1	529	502	562
78C-1	1078	1100	892
71C-1	731	759	701
80C-1	734	611	618
82C-1	775	605	631
Within Sample Variation	7.4%	11.3%	20.4%

Each figure is an average of four determinations. The assays are expressed in units per mg. in terms of the arbitrary standard.

The potencies obtained by Method 3 agree with those from the *S. aureus* broth test more closely than those from Methods 1 and 2. Both Methods 1 and 2 gave results which were 120 per cent of those from the turbidimetric assays, whereas the comparable figure for Method 3 was only 105 per cent.

It can be seen that the experimental error for the second group of unknowns was almost the same in both cases for the *S. aureus* broth test (10.7 per cent and 11.3 per cent). The experimental error for the disc plate method was only 7.4 per cent. It would appear that in our hands this method gave the most reproducible results. This is probably due in part to the favourable dosage-response curve.

Summary

Attempts to assay subtilin by accepted plate methods proved unsuccessful as only negligible zones of inhibition were produced with high concentrations of the antibiotic and a sensitive organism. On the assumption that the rate of diffusion was too slow to prevent the multiplication of the rapidly growing organism, experiments were undertaken to achieve a more useful balance between these factors. Preliminary refrigeration with subsequent incubation proved to be a practical method. This has been carried out in several ways, the most useful of which is refrigeration for 20 hours followed by either incubation at room temperature for 16 hours or at 37° for 6 hours. If the shorter incubation is used, the plates are developed by a modification of the techniques of Pratt and Dufrenoy.

Two cup plate methods are described. Nine samples were assayed four times by these two techniques and by two turbidimetric methods described by Lewis. The within-sample variations were 10.9 and 13.9 per cent, 10.7 and 18.8 per cent respectively.

One disc plate method is also described. The use of discs was made practical by the addition of Tween 80 to the medium. A second group of 9 samples was assayed four times by the disc plate technique and by the two turbidimetric methods. The within-sample variations were 7.4 per cent for the disc plate and 11.3 and 20.4 per cent for the broth tests.

It appears that the disc plate method gives the most reproducible results of any of the methods tried. The cup plate tests give results which are considerably higher than those from the turbidimetric tests. However, the disc plate and broth techniques give results which agree closely.

The sensitivity of the plate tests is much lower than that for the turbidimetric tests, the level of testing being 50 to 100 times higher.

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AN EPIDEMIOLOGICAL SURVEY OF CANADA

IN the field of public health The Rockefeller Foundation, particularly through its International Health Division, has made many important contributions. One of the most valuable of these is the epidemiological survey of Canada conducted by Dr. D. F. Milam and Dr. W. A. McIntosh at the invitation of the Department of National Health and Welfare. The report of the studies, initiated in 1945 and extending over fifteen months, was published recently.

The object of the survey was to define the needs of Canada in the field of epidemiology and to make recommendations as to desirable developments in the organization and policy of the Federal Department. In arranging for the survey, the International Health Division fortunately was able to have the services of one of its senior field officers, Dr. D. F. Milam, an experienced epidemiologist and public health administrator. The study was carried through with the closest cooperation of the staff of the Federal and Provincial Departments of Health. Every province was visited. The report reveals the thoroughness with which Dr. Milam studied both the Federal and the Provincial responsibilities and the problems peculiar to each province. Dr. Milam's office was provided in the Department at Ottawa, which afforded him the opportunity of knowing intimately the workings of the various divisions and the interrelationships of its various services.

It will be recalled that the program in epidemiology was first started in the Department of Pensions and National Health in 1937, with the appointment of an epidemiologist to the staff. In the subsequent two years a start was made in coordinating a program for the Dominion and for the Provinces in communicable disease control. The war brought to an abrupt end the work of this division and the service was suspended throughout the war years. As the end of the war approached, the need for a Federal service in epidemiology was reviewed and it was felt that a thorough and impartial survey should be made to determine if a Federal division of epidemiology should be established. To answer this, the problems of each province required to be studied and the overall picture obtained. In the conduct of the study, Dr. Milam was most successful and has added to his reputation as an outstanding authority in public health practice.

The report gives consideration to the responsibilities, duties, and functions of a Dominion epidemiological division and to the administrative principles

for the organization of such a service. It presents possible plans for the organization at the national level, including the continuation of the present Dominion activities in epidemiology, possible expansion of epidemiological services within the Laboratory of Hygiene, and, finally, the organization of a new service of epidemiology within the Department. Such a new service could take the form either of a new and separate division of epidemiology or an office within the Directorship of Health Services. In either case the work would be administratively separate from the Laboratory of Hygiene. It would coordinate epidemiological activities wherever carried out in the Dominion and it would promote field investigations of disease problems and the strengthening of local epidemiological services. The plan conceives of the new service as a cooperative agency which would stimulate or support other agencies capable of carrying on epidemiological work. Investigation of disease problems in collaboration with the Provincial services would be the fundamental work of this division. In this a close collaboration with the Laboratory of Hygiene would be necessary. The importance of this interrelationship is stressed. The laboratory and the field service would be brought together in close association, with each keeping the necessary autonomy to carry on its separate type of work. These plans are in accord with the guiding principles presented by Dr. Milam as essential to the success of any plan.

Among the recommendations supplementing the establishing of a division of epidemiology, promoting cooperatively an integrated nation-wide epidemiological program through the closest relationship with the Provincial Departments of Health, is the inclusion of cooperative arrangements with the universities, the National Research Council, and other agencies doing or planning epidemiological work. It is recommended also that the division of epidemiology undertake a specialized program of virus disease investigation in cooperation with the Laboratory of Hygiene. Dr. Milam indicates how such a program might be developed and how a start might be made. In this connection, it is appreciated that, at present, personnel trained in the study of virus infections are few in number and that laboratory facilities and equipment are very limited. The development of this program of virus disease investigation would of necessity require a period of years.

The report has received careful study by the officers of the Department of National Health and Welfare, and appreciation of this important contribution to public health has been expressed to The Rockefeller Foundation by the Department and by the Dominion Council of Health. A division of epidemiology has been established in the Department and an epidemiologist has been appointed. Plans are being made to implement the recommendations in regard to the study of virus infections. The administrative principles for the organization of a Dominion epidemiological service, outlined by Dr. Milam, form the basis of the plan of the new division. It must be gratifying to Dr. Milam, Dr. McIntosh and members of the International Health Division that their survey has been so helpful and that it has been possible for the Department of National Health and Welfare to make a substantial start in developing an epidemiological service in Canada.

A Public Health Unit Plans a Mental Health Service

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THE beginning of the Mental Health Service of the Edmonton Rural Health Unit was the result of plans and efforts going back a number of years. Our thoughts and actions are influenced by our education, training and experience. The development of a project such as the one here described is not the product of one person's ingenuity but rather the result of training and experience and his associations and contacts with people engaged in similar or allied occupations.

After a limited period of training and service in a mental hospital, Dr. Siemens changed to health unit work where he engaged in a variety of enterprises including a camp for malnourished boys, a special program in nutrition, a summer school in public health and nutrition for teachers, and active adult study group work. In these various activities as well as in the day-to-day routine of health unit work, problems related to the mental health field arose. Advantage was taken of the opportunity to discuss some of them with members of the Mental Health Service, particularly with Mr. Kibblewhite. This was very helpful but often pointed out the limitations of the existing service, limitations which were recognized best of all by the members of the staff of the Mental Health Service. One was always reminded that the existing service was largely a diagnostic treatment and custodial one, ready to assist after symptoms of damage or trouble appeared. The Guidance Clinic, with its able, enthusiastic and hard-working staff, dealt mainly with cases already showing evidence of damage.

We recognize that a local health department possesses flexibility in program and budget which has so far not been developed on a Provincial scale and makes it possible for it to adapt itself more readily to meet existing needs. From the public health point of view, the existing mental health services may be compared with those of the physician who treats his typhoid fever patient without regard for the source of infection and its spread. Preventive methods work in other fields of medicine; they should work in the mental health field also. The underlying causes of mental illness can often be determined just as surely as those of other communicable diseases, and the mentally ill may be as great a menace to the health of the community as a case of typhoid fever.

If these statements are correct, some remedy can be found. This remedy may not lie with the present Mental Health Service, the local Health Services, nor with the existing services of the Department of Education. It probably lies, rather, in a close integration of all these services. One important consideration is that an initial attack must be made somewhere.

The resources available to local health departments are generally quite limited, making it necessary on occasion to engage in programs that are not at all the ideal visualized but rather the best than can be done in the circumstances. In 1944 discussions were started with other public health workers, teachers, Boards of Health,

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and School Boards, and members of the Provincial Department of Health and Mental Health Service, regarding the possibility of making a modest beginning in a preventive or positive mental health program in a health unit. Mr. John A. MacDougall, who had shown a keen interest in the work, and had the academic and personality qualifications and wide experience in teaching, consented to take the necessary training and embark on this program. Dr. A. R. Schrag was made acquainted with the plans and very kindly explored the possibility of obtaining a year's Fellowship for Mr. MacDougall from the Children's Fund of Michigan. On receipt of a favourably reply, our Deputy Minister of Health, Dr. M. R. Bow, who had approved of the project, made formal application for the Fellowship, which was granted in June, 1945, and provided training for a period of ten months at the Children's Centre in Detroit.

Because our beginning had to be necessarily a modest one, the initial plans were to restrict the direct service largely to the school population and:

1. Emphasize primarily the prevention of mental ill health.

2. Seek out those already in need of help, refer them to the Provincial Guidance Clinic, and assist in the implementation of advice given by the Clinic. Any assistance in the home was to be supplied through the teachers and our nurses' home visiting service.

The major limitations of the program were recognized and we were therefore pleased when Dr. John Dorsey, Director of the Children's Centre, Detroit, to whom the plan was referred, endorsed it.

Preliminary plans were made about this time to organize a summer school in constructive medicine for teachers of our Health Unit. This school was to train them for more effective assistance in this as in other functions of the Health Unit.

During the summer of 1946 discussions were started with Mr. R. J. Scott, Superintendent of the Sturgeon School Division and the Board of this School Division, suggesting that the proposed program be carefully integrated with the other services of the Health Unit in that area. The result was that the appointment of Mr. MacDougall, as Supervisor of Mental Hygiene for Schools of the Sturgeon School Division, was approved and his salary was paid in full by that School Division. It was agreed that he would work through the Health Unit office, which would provide office space and transportation. It was further agreed that he would work under the direction of a committee composed of Dr. A. R. Schrag, Clinic Psychiatrist of the Provincial Guidance Clinic, in Edmonton, Mr. R. J. Scott, Superintendent of Schools, the Medical Health Officer of the Health Unit, and Mr. MacDougall himself.

The kindly consideration and generous support given our proposal by Mr. Scott and his School Board leave us deeply indebted to them. Their favourable decision made the initial implementation of the plan possible and provided the funds necessary to carry on the program during the 1946-47 school year.

An account of the first year's operation of this program will form the subject of a separate paper. At the end of the first year, the program was extended to include the other half of the Health Unit and was financed totally through funds raised by taxation of that area.

Observations on DDT

ALEC STUART O'HARA, M.R.SAN.I., C.S.I.(C.)

THE practical application of DDT to pest control problems is constantly under review and more positive standards of practice have been attained within the past year. To the review of uses contributed by Baillie (1) may be added some more specific details in method.

During 1946, latrine interiors in a series of logging camps were treated with a 5 per cent water-wettable DDT powder suspension, applied with an agricultural spray. One year later, these treated surfaces were still insecticidal, after having been subjected to extremes of temperature ranging from 92° F. in summer to 45° below zero in winter. Screen doors and windows were found to require treatment with 5 per cent residual spray at intervals of six weeks, the method employed in this case being to apply the material by brushing. One application of the 5 per cent residual spray to garbage-collection stations, platforms, etc., permanently reduced the fly population in covered stations, but on weathered surfaces further applications at monthly intervals were required.

In kitchens, small food establishments and storerooms where the number of flies was small, the suspension of cords impregnated with DDT has given good results. The authors (2) recommended soaking the cords in 35 per cent DDT xylene solution, but as this material was not readily available, the writer has used strings treated with ordinary residual spray, with some degree of satisfaction. Treatment of cross-members, walls, picture rails, and other natural flylighting surfaces with 5 per cent residual spray has given good results. The technique of Baker and Scudder (2), involving a fan-shaped spray pattern and a concentration of 200 mg. DDT per square foot, has been followed.

For bed-bug control the 5 per cent residual spray has proved adequate. In addition to other normal harbourages, attention should be directed to the backs of picture frames (3). It has also been suggested that an atomizing nozzle having a discharge rate of one-tenth gallon per minute at 40 pounds' pressure in a flat fan-shaped spray of approximately 50 degrees is the most satisfactory method for treatment of beds (4).

During a year's widespread use of DDT compounds in the writer's area, no cases of DDT poisoning have been reported. The following precautions are normally taken:

a. Buildings under treatment are fully ventilated.
b. Operators wear waterproof gloves and apply the spray to a surface by holding the nozzle one foot from the surface being treated.
c. Overalls are worn.
d. Operators wash thoroughly with soap and warm water on completion of the work.
e. The spray is not used in the vicinity of unprotected foodstuffs.

The greatest current difficulty is to restrain the public from applying DDT with small hand-sprays (which are almost valueless for the purpose) and in the same manner as insecticides of the pre-DDT era.

Sanitarians are well advised to use every effort to induce the public to consult the health department on methods of application and personally supervise the use of DDT in food establishments until the proprietors have learned correct techniques.

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ABSTRACTS

Preventive Medicine and the Future of Medical Practice.

THIS article is based largely on an address by Perrin H. Long to a conference of professors of preventive medicine in which Long emphasizes his view that preventive medicine is "not public health in the general educational or practical sense", that "preventive medicine is a philosophy, a way of thought and life, a subject which should permeate a large part of the medical curriculum and the whole of the practice of medicine". With this interesting and sound concept, the aim for a department of preventive medicine becomes "one of gradual self-extinction in every medical school". "Its success should only be considered complete when, owing to its efforts and endeavours, the level of instruction in and practice of humanistic medicine has been raised to such a point in all departments in a medical school that the continued presence of a department of preventive medicine is unnecessary". Approval of such concept would be very general but the eventuality would seem to be well in the unpredictable future. In the meantime, every practitioner should because of his special training and responsibility utilize preventive medicine to increase positive health, bodily and mentally.

Editorial, M. J. Australia, 1947, II: 113.

Transmission of Epidemic Gastroenteritis to Human Volunteers By Oral Administration of Fecal Filtrates.

THE EXPERIMENTS described in this paper make an important contribution to our knowledge of epidemic gastroenteritis. The well-recognized role of staphylococci and salmonella as food-poisoning organisms causing gastroenteritis has in the past lulled suspicion of other agents producing somewhat similar disturbances. However, in many outbreaks of gastroenteritis, investigation has failed to reveal a responsible bacterial infection.

The present study was made on material obtained in the course of an epidemic in a state hospital. Altogether 589 cases, with 7 deaths, occurred among 2,623 inmates and 115 cases among 354 employees in a period of 1½ months. Starting in one building, the disease spread to all the others of the institution. Spread appeared to be by direct person-to-person contact, and milk, food, and water did not appear related. There was evidence of a less precise nature that the population of upstate New York was also affected by outbreaks over a period of time. Many other hospitals underwent similar experiences.

Clinically, the illness was not unlike gastroenteritis due to other agents. Fever, however, was usually absent or slight. The mean incubation period in 10 artificially infected cases was 3 days with a range of 1 to 5 days. Recovery in 2 to 4 days was the rule but occasional cases required a week.

Bacteriological investigations were negative for organisms known to cause enteric disease but oral administration of stool suspensions or throat washings to adult human volunteers induced the disease. The illness was transmitted in series and the agent was found to be filtrable. It would thus seem that a virus, likely one of a number, has been established as a cause of gastroenteritis. Nebulized throat washings inhaled by volunteers gave negative results.

Irving Gordon, Hollis S. Ingraham, and Robert P. Korns, J. Exper. Med., 1947, 86: 409.

Examination for Tubercle Bacilli by Gastric Lavage and by Laryngeal Swab: A Comparative Study.

GASTRIC LAVAGE as an ancillary measure for the diagnosis and management of tuberculosis has a long history and a good record. Laryngeal swabs for the same purpose, while not new, have only recently received extensive trial. The present report reviews use of the two methods, noting results of a comparative study as well as describing techniques and practical problems.

Results of cultures from 193 patients showed that three consecutive laryngeal swabs were as sensitive as a single gastric lavage. Since the swab technique is more acceptable from the patient's point of view, and less troublesome to the nursing and laboratory staffs, it should be considered for routine use in hospital and out-patient clinics.

A. G. Hounslow and G. Usher, Tubercle, 1948, 29:25.

Studies in Enterococcal Food Poisoning. 1. The Isolation of Enterococci from Foods Implicated in Several Outbreaks of Food Poisoning.

FAILURE to find well-known enteric pathogens, such as shigella and salmonella organisms, or staphylococci, does not exclude the possibility that a food poisoning outbreak is bacterial in origin. Apparently a search for enterococci is not infrequently indicative of the aetiology. The authors review the subject of streptococcal food poisoning and present evidence from investigations of four outbreaks to show that enterococci were the predominant organisms isolated from the suspected foods which were canned evaporated milk, charlotte russe, roast beef and ham bologna. Their epidemiological, clinical, and bacteriological data suggest strongly that enterococci, identified as *Streptococcus faecalis*, was causally related to these four outbreaks. The affliction was usually mild with one or more of nausea, vomiting, diarrhoea, and abdominal cramps. The incubation period varied in the different outbreaks, the extremes being 2 to 12 hours. Recovery occurred in from a few to 48 hours.

It becomes the part of wisdom to regard this organism as suspect and to include it in our thinking on this subject.

L. Buchbinder, A. G. Osler, and G. I. Steffen, Pub. Health Rep., 1948, 63: 109.

Streptomycin: A Valuable Anti-Tuberculosis Agent.

WHILE by no means the ideal antibiotic for tuberculosis, streptomycin has made a definite contribution to the therapy of this disease. A general account of investigations and experience in its use, together with an assessment of its value as evident at the moment, is presented in this paper and should command wide interest. The presentation includes a historical résumé of attempts to employ chemotherapeutic and antibiotic agents against tuberculosis, and observations on the efficacy of streptomycin in experimental tuberculosis followed by a summary of results in various forms of the clinical disease and notes on problems of toxicity and development of resistance to the drug.

Briefly summarized, it may be said that early streptomycin treatment of miliary tuberculosis and tuberculous meningitis brings about a remission in 50 per cent of cases. Some of these have remained well for over two years. Others have had a recurrence and in such cases, or when the tubercle bacillus has developed a resistance to the drug, further treatment is unavailing. In pulmonary disease, the actively progressive process is often halted, at least temporarily, and streptomycin has proved to be a valuable addition to other therapeutic measures in these selected cases. Ulcerative lesions of the larynx, trachea, bronchi, pharynx and tongue respond well in the majority of cases. Early symptomatic relief is observed in the majority of cases of tuberculous enteritis. Even though "cure" is not obtainable in these last categories, treatment is felt to be well justified. While ineffective alone in bone, joint and abscess forms of the disease, streptomycin facilitates surgical intervention.

Development of resistance to streptomycin by the tubercle bacillus is pronounced and constitutes the most serious limitation of its usefulness. The drug is also toxic but with a trend to the use of smaller but effective dosage this factor is becoming of less importance.

Finally it is emphasized that case selection is essential, that streptomycin is an adjunct to other tried forms of therapy and that hope and search for some more effective drug or combination of drugs should be maintained.

W. H. Feldman and H. C. Hinshaw, B.M.J., 1948, Jan. 17, page 87.

On the Verification of the Diagnosis of Tuberculosis

LABORATORY evidence to confirm a diagnosis of tuberculosis has become increasingly important both for the patient and the public health program. With more patients being admitted to sanatoria on X-ray findings alone, it is inevitable that some prove not to have tuberculosis. These should be spared mental shock and exposure to tuberculosis contact in the sanatorium. The limited sanatorium facilities and the good name of the early diagnosis programs are other important reasons for establishing diagnosis quickly. To this end, quantitative tuberculin testing and efforts to demonstrate tubercle bacilli in the sputum were carried out in a series of 1,376 patients newly admitted to a sanatorium. Direct or concentrated smears were positive for tubercle bacilli in only 51.5 per cent of cases whereas 94.7 per cent reacted to 1:1000 O.T. or less. In those positive to this strength of O.T. but with negative sputum smears retention in the sanatorium for full investigation is justified. Further

tests employing 1:100 and 1:10 O.T. were carried out on the approximately 5 per cent of patients who were negative to 1:1000 O.T. Such testing revealed that this group with low or no sensitivity to O.T. was composed of persons critically ill with tuberculosis and others in relatively good condition and non-tuberculous. These latter anergic individuals with negative sputum smears should be discharged from the sanatorium without waiting for the result of sputum cultures. Acid-fast organisms are demonstrated very rarely in such persons and invariably they prove to be saprophytes.

C. Eugene Woodruff, Pub. Health Rep., 1948, 63:184.

Observations on Rationing in Tuberculosis

WARTIME food restrictions and rationing in Great Britain provided an opportunity to test the universal belief that an adequate diet is essential in the treatment of tuberculosis and a satisfactory gain in weight an important indication of the patient's progress.

During the years 1938 to 1942 the averag gain in weight of the patients was similar to that in the years preceding the outbreak of war with the exception that a marked decline in weight gained occurred during the first half of 1941 coincident with a reduction in the meat ration and the introduction of rationing of cheese. The average gain in weight, low in the first part of 1942, rose sharply and maintained a steady climb for the remainder of the year coincident, in this instance, with an appreciable increase in the cheese ration.

Further reductions in meat and cheese rations later in the war produced similar declines in average weight gain. In addition, the substitution of suitable unrationed foodstuffs became increasingly difficult and the problem thereby exacerbated.

All other factors such as types of treatment and cases admitted remained virtually constant. Accordingly, the impression that the healing of the pulmonary lesion was a slower process during this period, borne out by the necessity of collapse therapy on an ever-increasing scale, could only be correlated with the dietary restrictions. The curtailment of protein and fat in the form of meat and cheese appeared to be the significant factor.

R. Y. Keers, Brit. M. J., 1948, Feb. 7, p. 245.

Smear Technique in Cancer Diagnosis

THIS article reviews the outstanding investigations of the vaginal-smear technique in the diagnosis of cancer of the female genital tract, uterus, cervix and vagina. To obtain a high degree of accuracy in this application of cellular pathology to the early diagnosis of cancer requires carefully trained, highly skilled workers. However, the record in such hands is very encouraging. Thus, Isbell and colleagues in 1,045 patients had a total combined error of false positives and false negatives of only 1.5 per cent.

It has been suggested by Gates and Warren that the vaginal-smear technique provides a valuable means of studying the sequence of changes in the metamorphosis of benign into malignant cells in such borderline conditions as a typical hyperplasia of squamous epithelium of the cervix. Likewise the method provides a tool for assessing the response of cancer cells to irradiation in terms of initial response and subsequent recurrence.

The extension of the technique for purposes of early diagnosis of cancer of other organs gives some promise. Especially is this true for bronchial cancer, where it has proved a useful adjuvant to other procedures. Limited study of genito-urinary cancer by this method is also encouraging. In general the method would appear to be applicable to cancer involving or communicating with any body cavity. It is to be hoped that further careful, skilled work will verify and extend its value.

Lancet, 1948, 1:330

Craigie's Vi Phage Method and South African Strains of B. Typhosus, with Special Reference to Typhoid Carriers

THIS article bears further testimony to the value of phage typing of typhoid bacilli in the epidemiology of the disease. Typing of 495 South African strains of the organism revealed a different distribution of the various types from that reported for other parts of the world. Some new types appear to have been encountered. In two outbreaks of typhoid fever, phage typing determined the responsible carrier and in one instance excluded an already known carrier who was under grave suspicion.

Clarice G. Crocker, J. Hyg., 1947, 45:118.

The Problem of the Older Worker

DURING wartime age was no barrier to employment but with the end of the war it again became a determining factor. By June 1, 1947, the "over 45" group accounted for 23 per cent of total unemployment. The question of permanent employment for this age group is now serious.

This article, prepared by the Research and Statistics Branch of the Department of Labour, is intended to show that the relative ability of older workers on the same type of work as younger workers, has frequently been underestimated. It also establishes the fact that there are a number of jobs for which older workers are specially suited. The net value of a worker depends rather upon physical fitness than upon age.

An objective evaluation of the older worker, based on available facts, is presented. The findings indicate that older workers save money for a firm because they have fewer accidents; their labour turnover is smaller, thus decreasing the expense of training new employees; their output usually equals that of younger men, and they cause less spoilage and breakage; they tend to be more stable, loyal and responsible, and are particularly valuable where there is little supervision. The chief disadvantages are: they lose more days through sickness than younger workers; they are less adaptable to sudden changes in assignment; they have less muscular strength and agility.

In connection with the basic problem—how to prolong the productive life of the worker who is now growing old on the job—various suggestions are made. An understanding of his changing capabilities is essential. Periodic aptitude tests and measurements of his physical stamina are necessary to his careful placement. Retraining programs within each plant can enable his continual readjustment; medical programs can maintain his physical and mental alertness.

Of equal importance is the problem of the unemployed older worker. The National Employment Service officers emphasize that, for these workers, steady and permanent employment is the great objective. Reference is made to the value of counselling as a means of discovering a man's greatest assets and enabling his placement in a suitable job. It is possible that a hobby might be turned into a profitable occupation or point the way to a new employment field. Jobs for which older workers are specially suitable are common to almost every type of industry. Among these are bench workers, elevator operators, guides, messengers, watchmen and many others.

Labour Gazette, 1947, 67:1251.

The Effect of Food Supplements on Poorly Fed Workers in Brussels in January, 1945

IN THIS article are presented the findings of an experiment to determine the effect of food supplements, which was conducted among a group of workers in Brussels in 1945. Their diet had been shown to be inadequate, and a supplement was given to correct the deficiency. The effects on weight, grip, urinary nitrogen excretion and the irritability of muscle to nipping, were measured, and their values compared with those given by a control group receiving no supplement. There were eighteen men under investigation.

All the men normally had a small mid-day meal at the works. During the periods of supplementation—two periods each lasting ten days—in addition to this meal, the experimental groups received highly nutritious dehydrated foods. These were milk, cheese, butter and eggs, with the addition, in the second experimental period, of beef. Tables are given to show the nutritive value of the supplements given during the two periods.

The authors present in detail the procedure followed in the measurement of weight, estimation of grip strength, estimation of muscle irritability, and in urinary analysis. Tables present the findings. Significant changes were found during the experimental periods in the group receiving the supplement. There was an increase in weight and grip and a decrease in the length of time for which local contraction of the biceps muscle persisted after mechanical stimulation. The addition of the supplements produced also a considerable retention of nitrogen; the large increase in protein nitrogen intake resulting from consumption of the supplement caused no pronounced increase in urinary nitrogen output. None of the changes, however, could be correlated when consideration was given to the changes occurring in each individual; neither was it possible to correlate any of the changes with the intake of any particular nutrient.

The authors state also that, while the gain in grip strength is statistically significant, it is impossible to eliminate the psychological factor. They explain that there is likely to be a greater urge to try hard in a subject who is receiving extra food than in one who is living on short rations and it is impossible to provide a "dummy" substitute for food in control subjects.

G. A. Smart, T. F. Macrae, P. A. Bastenie, and P. E. Gregoire, Brit. M.J. 1948, 1: 40.

BOOKS

Public Health Administration in the United States. *By Wilson G. Smillie, M.D., Professor of Public Health and Preventive Medicine, Cornell Medical College. Toronto: The Macmillan Company of Canada Ltd., 1947. Third edition. 637 pages. $6.50.*

THIS authoritative textbook was first published in 1945. It was written to meet the need for a summation of information as to established public health practices evolved during the early pioneering phases of public health organizations in the United States, and also to indicate future trends in the American public health field. To keep abreast of the rapid growth in public health, a revision was published in 1940; expansion since then, however, has been so marked, especially as the result of the stimulating effect of World War II, as to necessitate the publication of a third edition.

Canadian public health administrators and educators are conversant, of course, with the previous editions of Dr. Smillie's textbook. It would be superfluous, therefore, to undertake here an exhaustive treatment of the plan and character of this book. Suffice it to say that the newly revised text is subdivided into four major headings: Functions of a Health Organization and the Development of Public Health Administration in the United States; Administrative Control of Communicable Diseases; Basic Activities of Health Organizations; and the Organization of Public Health Programs.

Recent advances in the knowledge of epidemiology of infectious diseases relate in particular to scarlet fever and all the streptococci, the pneumonias, tuberculosis, venereal diseases, malaria, tetanus, epidemic cerebrospinal meningitis, and influenza. New antibiotics have changed concepts and procedures relating to such infections as plague, lobar pneumonia, and bacillary dysenteries. Progress in the field of environmental sanitation covers new concepts in housing, development of insecticides, and the introduction of methods for the control of airborne infections. New laboratory procedures relate to the detection of carriers, the rapid growth of the tubercle bacillus, and the isolation and cultivation of viruses: Chapters are devoted to such important public health considerations as nutrition, mental hygiene, industrial hygiene, public health education, and adult hygiene. An excellent discussion of the National Health Program is timely, owing to the growing interest in a comprehensive medical care program encompassing preventive services as well as curative and rehabilitation facilities. Such chapters as those dealing with budgets and budget making, rural health administration, and so forth, will be of particular interest to administrators.

A textbook of course cannot treat exhaustively the innumerable aspects composing the field of public health. Discrimination as to the selection of subject matter and the notation of leading references to the literature is essential to meet the needs of its various readers. From the study of such a book all benefit from the standpoint of orientation as to the public health movement as a whole, and at the same time readers with special interests should be guided to supplemental literature which will assist them in meeting their individual needs. In this respect Dr. Smillie's background of experience in public health, as well as that of an educator and an investigator, is reflected in the success with which he has accomplished his task as a textbook author.

Since public health practices and trends in Canada and the United States are sufficiently similar in character, this important publication may be recommended as a useful reference work to Canadian public health workers, and also an invaluable textbook to Canadian public health students in general.

W. A. McIntosh

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